Nilgiri Wheat News

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Leaf rust resistance gene *Lr* 34 recognised in some Indian bread wheat (*Triticum aestivum*) accessions

Jagdish Kumar, Vikas VK, Jayprakash P, Sivasamy M, Peter John, Nisha R

A total of 2200 germplasm accessions of *Triticum aestivum* (bread wheat) obtained from National Bureaux of Plant Genetic Resources (NBPGR), New Delhi, were planted at IARI, Regional Station, Wellington, Tamil Nadu during summer (May to September) of 2011. Observations were made on the presence of leaf tip necrosis (LTN) on flag leaf of these accessions. The scores of 40 and below were considered as resistant and those above 40 as susceptible. Three types of LTN symptoms designated as low, medium and high were categorised to find out their individual effect on the terminal severity of leaf rust in the accessions. It was noted that three different types of LTN do not behave differently for their effect on terminal severity of leaf rust. Present observations lead to a conclusion that accessions bearing LTN suffered less from leaf rust infection as compared to those without this trait. Since leaf tip necrosis has been proved to be genetically linked with gene *Lr34*, hence accessions of Indian wheat germplasm studied here can be assumed to possess this useful gene of resistance for leaf rust. These accessions may find their utility as genetic stocks for breeding varieties with durable resistance to leaf rust. These accessions can be procured from NBPGR, New Delhi after consulting the list at IARI, Regional Station, Wellington.

New effective leaf rust resistance gene *Lr*45 - deived from *Secale cereale* is successfully pyramided with other rust resistance gene(s) in the back-ground of several Indian popular wheat cultivars at IARI, RS, Wellington

Sivasamy M, Vinod, Jayaprakash P, Vikas VK, Jagdish Kumar,.Nisha R and Sivan K

A new effective leaf rust resistance gene *Lr* 45-derived from *Secale cereale* which confers high degree of resistance to all the occurring Indian leaf rust pathotypes has been successfully incorporated into popular Indian bread wheat cultivars. A well planned breeding program to incorporate this gene and pyramiding it with other effective stem and stripe rust genes was initiated during Kharif, 2008 at IARI, Regional station, Wellington for the first time in India. Popular Indian bread wheat cultivars viz.,C 306, GW 273, HD 2189, HD 2285, HD 2329, HD 2402, HD 2687, HD 2733, HD 2877, HI 977 HI 1077, HP 1205, HS 240, HUW 234, J24, Kalyansona, Lal Bahadur, LOK-1, MACS 2496, NI 5439, NIAW 34, PBN-51, PBW 226, PBW 343, PBW 502, RAJ 3077, UP 2338, UP 2425 WH 147 and WH 542 were taken for introgression of *Lr* 45 and pyramiding it with *Sr*31, *Sr*36 and *Yr*10. The conventional and molecular assisted back-cross program was employed to deploy the genes.

The back-crossed lines confirmed to carry *Lr* 45 were picked at BC3F2 stage and stable lines were constituted at BC3F5 stage. The top cross was effected to F1 lines carrying *Lr* 45 to incorporate *Sr*36+*Pm*6, *Sr*31+*Lr*26+*Yr*9+*Pm*8 and *Yr*10. Final

constitution for the lines in the background of popular bread wheat cultivars carrying *Lr*45 alone and with *Sr*36+*Pm*6 were already constituted, ascertained with HW numbers and forwarded for yield trials. These will be shared shortly with Indian wheat scientists engaged in wheat improvement after proper documentation and registration. From our observation the following traits are tightly associated with *Lr*45.

- Pink awns/pink coloration of the glume border observed to remain only for some time and disappears during milking stage which is thermo-sensitive and get expressed only at low temperature - a very effective phenol-typical marker
- Laxy ear and bold grains resulting in increased grain weight
- Significantly increased number of tiller per plant and final grain yield
- Waxy stem and leaf
- Results in all the lower most fertile spikelet invariably even though the recurrent parent has the trait of sterile. Lower most spikelet is like PBW 343.

In the absence of any robust genetical marker in the world, the prominent phenol-typical marker (Pink awns) is under investigation for marker validation in the Division of Genetics, IARI, New Delhi.

Impact of Front Line Demonstration trials of IARI Regional station, wellington in Southern Hill Zone (SHZ)

Jayaprakash P, Jagdish Kumar, Sivasamy M and Vikas, VK

The FLDs have been regularly conducted to popularize the recently released wheat varieties of this station for Southern Hill Zone which includes Nilgiris, Coimbatore, Erode, Krishnagiri, Dharmapuri, Salem, Vellore, Thiruvannamalai etc. districts of Tamil Nadu and Mandya district of Karnataka. Under this program, beneficiaries were identified and they were supplied with wheat seed and other inputs. In 2010-11, totally 20FLDs were conducted which included 35 farmers. In 2011 – 12, only 8 FLDs were sanctioned and seeds of the variety COW(W) 1 was supplied to 17 beneficiaries. Introduction of wheat in non-traditional areas has been successful and met the overwhelming response We have conducted two field days , one at Regional Research Station, TNAU, Paiyur on 15.02.2012 and another at Zonal Agricultural Research Station, UAS , Mandya on 16.02.2012. During field day, scientists briefed about wheat cultivation and their management practices, then farmers were taken to the field and they were shown the AICW&BIP programmes which have *Triticum aestivum* and *T. diccocum* trials. The demand for wheat seed is increasing and farmers are frequently contacting in person or phone. Keeping in view multiplication of seed has been taken more vigorously in this season.

Through our personal field surveys and reports of FLD beneficiaries, it is estimated that area under wheat cultivation in hilly and non traditional wheat areas of Tamil Nadu and Karnataka has increased to approximately 5000 ha compared to 2000 ha in 2006.

Winter x spring wheat hybridization at IARI Regional station, wellington

Jayaprakash P, Sivasamy M, Vikas, VK and Jagdish Kumar

A significant progress has been made to cross spring wheats with winter types. The aim of the hybridization is to transfer high tillering and yielding ability from winter to spring wheats. Last season, 91 winter types were acquired from VPKAS, Almora and were sown at wellington. The facultative winter types have come to flowering (66 lines) and they have been crossed with elite lines of spring wheats. Other lines which are in vegetative phase need extra light and effort are in progress to provide conducive conditions to make them flower and utilize them further.

Effect of herbicide application on artificial disease progression of brown rust (c.o. *Puccinia triticina* Eriks.) in wheat (*Triticum aestivum* L.) investigated

Jagdish Kumar, Vikas VK, Jayprakash P, Sivasamy M, Peter John, Nisha R

Interference of various herbicides on brown rust development in wheat was investigated since it is a common practice to apply herbicides pendimethalin at pre-emergence as well as 2,4-D and metribuzin at post – emergence stages for achieving an effective weed control as manual uprooting is laborious and uneconomical. Herbicidal treatments showed their effects on the progression of brown rust in a manner either dependent upon their chemical composition or the method of application. Pendimethalin did not interfere with the brown rust build up while 2,4-D and metribuzin put a restraint on build up of brown rust but only temporarily. Brown rust progression in the plots treated with 2,4-D and metribuzin normalised in the later stages. Hence, there is no harm in applying these herbicides in brown rust screening plots for easier and more effective weed management as compared to hand weeding. However, application of 2,4-D and metribuzin may not be suitable in experimental plots meant for recording brown rust response at early growth stages of wheat especially while enumerating the parameters of slow rusting etc. since both these herbicides had static effect on brown rust build up in the initial stages.

Wheat rust surveys in Nilgiris

Jagdish Kumar, Sivasamy M, Vikas VK, Jayprakash P, Peter John and Nisha R

Three pathotypes viz. 77-5, 77-7 and 77-8 of brown rust (*Puccinia triticina*) and two pathotypes viz. 40 A and 40-1 of black rust (*P.graminis tritici*) of wheat prevailed in Nilgiri hills. Pathotype 77-5 in brown rust and 40A in black rust dominated the field flora. Ug 99 and its variants could not be observed in the trap nursery. Pathotype 78S84 of yellow rust (*P. striiformis*) also existed in Nilgiris.

Wheat germplasm evaluated for disease resistance under natural epiphytotics of rusts, foliar blights, powdery mildew etc.

Jagdish Kumar, Peter John, Sundeep GM, Sharma, JB, Singh GP, Gogoi, R., Jindal Madhumeeta, Kumar Subodh, Saharan MS and Singh Mangal

NBPGR planted around 22000 accessions of Indian wheat germplasm for evaluation of resistance to various wheat diseases under natural epiphytotics at IARI, Regional Station, Wellington. This collection of wheat germplasm was originally maintained in the long term storage at NBPGR and comprises the wheat accessions contributed by co-operating centres of AICW&BIP since the inception of this coordinated project in the early sixtees. More than a dozen of trained wheat scientists and technicians were deputed to score reactions of accessions to various diseases. Data of accessions on their reaction to diseases are available with IARI, Regional Station, Wellington and NBPGR, New Delhi.

DBT project "*Puccinia triticina* genomics network on *de novo* genome sequencing, fitness, variation and pathogenecity

Jagdish Kumar, Sivasamy M and Peter John

Two populations of NILs named HW 2016 (PBW 226+*Lr*24) and HW 2057 (PBW 226+*Lr*9) were investigated simultaneously for their response to race 77-5 (strong race) and 17(weak race). PBW 226 was also tested as check alongwith a super susceptible wheat variety WL 711. Lines HW 2016 and HW 2057 exhibited a low infection type (;2) at seedling stage (7-day-old seedlings inoculated and reaction recorded at 10^{th} day of inoculation). Both lines showed complete freedom of brown rust while tested at adult stage by inoculating at boot emergence stage and observed for rust severity at late dough stage. PBW 226 without genes *Lr*24 and *Lr*9 revealed 3+ reaction type at seedling stage while 80s terminal severity at adult stage. Super susceptible wheat line WL 711 also developed 3+ reaction at seedling stage but 100S at adult stage. Leaf samples of all test lines mentioned above have been prepared

for cytological observations after 24, 48, 72, 96 and 120 hour after inoculation at seedling stage. Samples have been preserved in 50% glycerol solution and will be microscopically in due course of time. Leaf samples of all time points meant for cytological investigations have also been provided to TNAU, Coimbatore for cDNA_AFLP based expression profiling.

DBT project "Marker assisted introgression of genes for triple rust resistance in elite cultivars of bread wheat (*Triticum aestivum* L)".

Sivasamy M, Vinod, Jayaprakash P, Vikas VK, Jagdish Kumar and.Nisha R

The seeds received from the co-operating centres viz., IARI, New Delhi and IARI, RS, Indore, BHU, Varanasi and MACS, Pune were planted and used in the programme of back-crossing. Progenies of top crosses as well as three way crosses were molecularly confirmed at IARI, New Delhi to verify introgression of *Lr* 24, *Lr* 34, *Yr* 10, *Yr* 15, *Sr* 25 and *Sr* 26 in the popular bread wheat cultivars HD 2733, HD 2932 and HD 2967. Further backcrosses were effected to develop stable lines with single resistant genes. Successfully transferred *Thinopyrum ponticum*-derived stem rust gene from bread wheat to durum wheat cultivar HI 8498 through inter specific hybridization for the first time in India. This will act as easy to introgress - genetic stock for the centers willing to transfer this effective gene conferring rust resistance against stem rust pathogen.

BAARC/ BRNS project "Molecular characterization of T. dicoccum derived rust resistance wheat lines and reducing the linkage drag through irradiation

Sivasamy M, Jayaprakash P, Vikas VK, Jagdish Kuma and Punniyakotti E.

Five elite inter-specific wheat lines (*T.dicoccumx T.aestivum*) developed at this station were subjected to irradiation and M1 planted and the single plant progenies harvested. These will be advanced to M2 with an aim to delink the traits associated with larger segment as linkage drag. Further inter-specific crosses between *T.dicoccum x T.aestivum* are in F1 stage. The five elite inter-specific wheat lines (*T.dicoccumx T.aestivum* were separately crossed with WL 711, Lal Bahadur, NI 5439 in order to develop mapping populations in order to understand the genetic basis of resistance and the material is in BC1 stage.

Summer Nursery Notice

Off- season sowing for crops such as Wheat, barley, mustard, sunflower, lentil, Bengal gram, pea, safflower etc. will commence in the month of May, 2012. Following points are hereby brought to the kind notice of all concerned:

1. Seed materials of wheat, barley and triticale (main emphasis) and other crops of your centre must reach Regional Station, IARI, Wellington latest by 20th May, 2012.
2. A proper sowing plan as well as pedigree details should accompany your material.
3. Summer nursery facility is mainly extended to breeding materials to be subjected to generation advance, corrective crossing, multiplication of seeds to a limited scale and disease scoring under natural hot spot environment.
4. The purpose of planting should be duly indicated along with your choice for material to be harvested or not. Also mention if disease (rusts, powdery mildew etc.) are required to be recorded.
5. Summer nursery facility to organizations other than ICAR institutes, SAUs and any other Govt. sponsored institutes will be on payment basis and the details will be supplied on demand.
6. It will be appreciated if user or representative are present physically at the time of sowing.
7. Important contacts:

Dr. M. Sivasamy, Sr. Scientist – Farm Incharge and Guest house Incharge (09442350239),Dr P. Jayaprakash, Sr.

Scientist – Summer Nursery Incharge (09842506455)

News:

- Dr. Vikas V.K. Scientist (Wheat Breeding) has been deputed to CIMMYT, Mexico to undergo a three months training on wheat breeding, genetics and pathology.
- Dr. P. Nalthambi, Sr. Scientist (Plant Pathology) and Dr. U. Maheshwari, Sr. Scientist (Plant Pathology) have joined the station in the month of April, 2012