Number 56 April-June, 2014

Research Highlights

Prevalence of Potato virus X strain groups in India

Potato virus X (PVX) is one of the mosaic inciting viruses in almost all varieties of potato. The virus is distributed throughout the world and results in yield reduction up to 30 %. Strains of PVX have been classified into four groups according to their reactions with the dominant resistance genes Nb and Nx and with the extreme resistance gene Rx. Group 1 strains cause a hypersensitive response in the presence of Nb or Nx, group 2 only with Nb, group 3 only with Nx and group 4 with neither, and fails to infect plants carrying Rx gene. The coat protein gene (CP) of PVX is known to affect the outcome of interactions between different strains of the virus and the potato plant carrying the Nx and Rx gene. Phylogenetic placement and resistance strain grouping based on CP gene sequence length and amino acid sequence identities have been reported. Hence, to identify different PVX strain groups prevalent in India, CP gene of fifty three isolates collected from different potato growing regions was determined. The CP gene of these isolates shared 94.8-100.0% and 98.3-100.0% similarity at nucleotide and amino acid sequence level, respectively. They were compared with different PVX strain groups. In a phylogenetic analysis, most of the isolates (60.38 %) were grouped with the isolate, sam-15 from Scotland (GU144351) to which they shared maximum of 97.7-98.7% similarity while 24.53% isolates were found in a separate cluster with two Indian isolates reported earlier (GU256064 and FJ643623). Two isolates from Shillong and three isolates from Bihar were grouped with the isolates from China and Australia. All the fifty three isolates had 714 bp coat protein gene and were found in clade I (strain groups 1, 3 and 4) and

Potato plants showing mild mosaic symptoms under field conditions

Issue Highlights

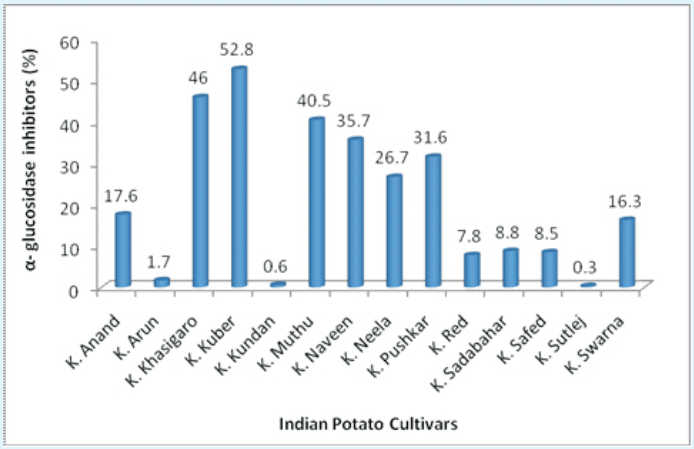
none of them in Clade II (strain groups 2 and 4). Hence, these isolates belong to either of the strain groups 1, 3 and 4. However, biological assay on potato cultivar differentials needs to be done to assign the Indian isolates into strain groups.

- A. Jeevalatha, Ravinder Kumar, Baswaraj R., Sanjeev Sharma, V. Sagar and BP Singh

Potential of Indian Potato Cultivars to Prevent Hyperglycemia

The natural forms of α-glucosidase and α-amylase inhibitors that we ingest through our daily diet have potential to prevent hyperglycemia helping manage the incidence of type II diabetes. α-amylase and α-glucosidase inhibitors inhibit the breakdown of starch after consumption and absorption of glucose in the small intestine, respectively. α-glucosidase inhibitory enzyme/ inhibitors contributes in management of hyperglycemia, linked to type II diabetes. Therefore early stages of type II diabetes could be controlled via inhibition of α-glucosidase, which participates in the overall digestion and uptake of carbohydrates from the diet. Foods with high α-glucosidase inhibitor and low or medium α-amylase inhibitor are considered ideal to avoid digestive complications from undigested starch. Till date, the presence or absence as well as the concentration of α-amylase inhibitors and α-glucosidase inhibitors was not known in Indian potato cultivars. Therefore, to measure the α-amylase and α-glucosidase inhibitory activity from Indian potato cultivars, methods were standardized.

The in vitro α-glucosidase inhibitory activity of Indian potato cultivars exhibited a large variation and the activity ranged from 0% to 52.8%. Out of the 46 tested cultivars (40 cultivars for table purpose and 6 cultivars for processing purpose), the α-glucosidase inhibitory activity was observed in 14 table purpose potato cultivars viz. Kufri Anand, Kufri Arun, Kufri Khasigaro, Kufri Kuber, Kufri Kundan, Kufri Muthu, Kufri Naveen, Kufri Neela, Kufri Pushkar, Kufri Red, Kufri Sadabahar, Kufri Safed, Kufri Sutlej and Kufri Swarna. The α-glucosidase inhibitory activity was the maximum in Kufri Kuber, followed by Kufri Khasigaro and Kufri Muthu. α-amylase inhibitory activity was found only in Kufri Frysona (20.5%) amongst all the tested cultivars. Potato cultivars with high α-glucosidase inhibitory activities can further be used for in vivo studies as part of therapeutic or clinical strategy for the management of hyperglycemia linked to type II diabetes.



α-glucosidase inhibitory activity percentage in Indian potatoes

Pinky Raigond, Brajesh Singh and Som Dutt

Occurrence of *Sclerotinia sclerotiorum* and its mode of infection on potato

Sclerotinia is a ubiquitous, omnivorous, necrotrophic and sclerotial phtytopathogenic fungus and having more than 400 plant species host. It is a cool climate and humid loving pathogen found on almost all the host during winter season. Sclerotinia sclerotiorum is the only major species found worldwide without any host specificity like *Sclerotium rolfsii.* So far, no vegetable crop has been found free from *Sclerotinia sclerotiorum.* Potato is a vegetatively propagated crop and in variety Kufri Himalini, the drooping of plant was observed at Kufri. Close observations revealed white fungal growth near stem base and the pathogen was identified as *Sclerotinia sclerotiorum.* Splitting of infected plants clearly revealed Sclerotia of the pathogen. Similarly in net house at CPRS Jalandhar, dehaulmed plants of most of the variety were infected with white rot symptoms on the stems. These stems were carefully splited and lot of elongated sclerotia was observed. The pathogen was identified again as *S. sclerotiorum.* In variety Kufri Chipsona-1 at CPRS, Gwalior the flowers and its petals were infected with white cottony fungal growth. The isolation clearly revealed the pathogen as

S. sclerotiorum. This pathogen is monocyclic and its sclerotia survive in soil for several years which formed apothenia in cool, cloudy, wet and shady conditions. The mode of primary infection is only through ascospores developed in apothecia from fallen sclerotia in soil. The short lived ascospores forcibly released from ascus and fall on flowers as well as all parts of the plants and germinate but can cause infection only on petals. All the germinating

Infection of *S. Sclerotiorum* on different Plant Parts

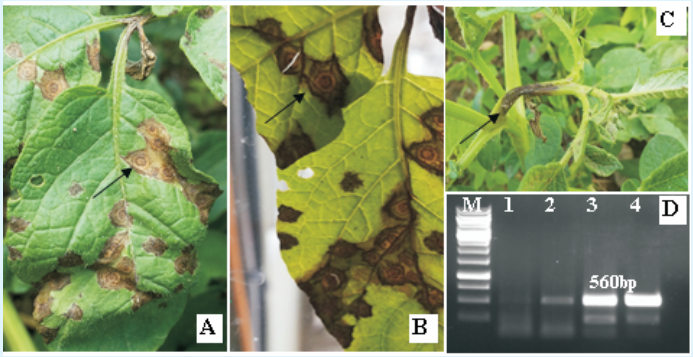
ascospores on leaves, stem, fruits cannot penetrate hard cuticle and waxy layers but easily infect delicate petals and colonize.

The infected petals have enough inoculum potential to create infection on other plant parts which come in contact for subsequent infection. In absence of potato flowers, it infects flower of weeds available in vicinity of potato plant and the infected flower of weeds leads to infection in potato plant. It is evident that *S. sclerotiorum* is spreading very fast in potato and the source of primary inoculums is ascospores and site of primary infection is flower in potato.

K.K. Pandey, R.K. Arora, B.P. Singh and S. Roy

Occurrence of Groundnut bud necrosis virus on potato in Shimla

Groundnut bud necrosis virus (GBNV) is a very serious problem in many crops like groundnut, sunflower, soybean, cowpea, mungbean and tomato in many parts of India. It has also been reported to infect potato where it causes stem necrosis disease i.e., Potato stem necrosis disease (PSND). Generally the symptoms are confused with *Phytophthora infestans* (late blight) infection but it is characterized by typical symptoms of dark brown necrotic ring spots on the leaves, necrotic spots on stem and petiole and stunting of the plants. Till date the literature suggests that the disease has not been observed on potato at Shimla whereas other hosts like *Tropaeolum majus, Hydrangea,* tomato, etc., do have infection at Shimla. During a field visit in the year 2014 we observed clear symptoms (as described above) of PSND in few plants. The symptoms were photographed (Fig. A, B and C) and the same leaf samples were brought to the laboratory and examined by RT-PCR and sequence analysis for verification of the exact cause. Hence, primers specific to Groundnut bud necrosis virus (GBNV) targeting coat protein gene with optimized PCR reagents and PCR conditions were used. The PCR amplified product was visualized on 1% agarose gel wherein a sharp amplicon of ~560 bp (Fig. D) was observed indicating the presence of suspected virus. The same amplicon was gel eluted and sequenced directly (ABI Genetic Analyzer). The sequence generated was aligned and found to be 522 bp after aligning with the help of Clustal W alignment software. The sequence was BLAST analysed which suggested that the query has 97% homology with the reported isolate of Peanut bud necrosis virus (PBNV) from Nellore (A.P; JF968415.1), Tirupati (A.P; HQ324115.1), Jalna (M.H; DQ375811.1) and GBNV isolate from Kanpur (U.P; JX524450.1). Hence, it is evident from our study that the disease is caused by GBNV. Since the disease was observed for the first time in Shimla and looking at the potential threat that the virus can cause to potato crop, it needs further detailed studies.



Potato plants showing typical symptoms of GBNV.
A & B; dark brown necrotic ring spots on the leaves,
C; necrotic spots on stem and D; RT-PCR detection of GBNV

Baswaraj Raigond, Jeevalatha A, Ravinder Kumar, Priya Sharma, Sanjeev Sharma, BP Singh and Tarvinder Kochhar

Training & Technology Transfer

Training programme for Farmers of West Bengal

The institute organized a 3-days training programme sponsored by NABARD, Kolkata for 19 farmers of Hooghly district of West Bengal during May 06-08, 2014. This training was given on the topic "Modern techniques for quality seed potato production". Lectures by the expert scientists from CPRI were

Training of farmers of West Bengal

delivered to farmers in different aspects of seed potato cultivation like planting of healthy tubers, fertilizer and weed management, water management, disease and pest control and improved methods of potato storage. Field visits to seed farms of CPRS, Kufri-Fagu was also organized to expose farmers to real-time situation.

Training Course for Officers from Mahindra Samriddhi

A two days training Course on "**Competency development in potato cultivation**" was organized during 23-24 May, 2014 at CPRI, Shimla. This training was sponsored by Samriddhi Mahindra and Mahindra, Mumbai. The main objective of this training was to improve the knowledge and skills of managers of the company regarding improved methods of healthy seed and table potato production. A total of 21 officers from different parts of the country participated in this training. Theory as well as practical session on nearly all aspects like planting, nutrient management, water management, disease and pest management, post-harvest operations, processing and storage of potato were conducted by the experts scientists of the institute.

Training programme for Farmers of Leh under Tribal Sub Plan

Two training programmes for tribal farmers of Leh district (J&K) was organized by CPRI, Shimla in collaboration with CAZRI-Regional Research Station (RRS), Leh, KVK (SKUAST(K), Leh and State Department of Agriculture, Leh under TSP. A total of 250 farmers participated in these training programmes during 27-30 June, 2014. Expert scientists from CPRI Shimla and RRS-CAZRI gave

Training of farmers in leh under TSP

lecture on different aspects of potato cultivation during this training programme. Lectures were delivered on suitable potato varieties, improved production technology of potato, diseases and pest management, soil testing etc. The team of experts also visited the potato fields of local area and advised farmers.

Live Phone-in Programme at Doordarshan & AIR

Scientists from CPRI, Shimla participated in various Live-phone in programme on different aspects on Doordarshan and All India Radio (AIR) from April to June, 2014. The details of the topics along with expert

Month	Topics (Doordarshan)	Name of the Expert
April	Seed preparation and planting of potato in higher hills of HP	Dr. Vinod Kumar Dr. Ashwani Kumar
May	Earthing up, fertilizer application and weed management in high hills of HP	Dr. VK Dua Dr SS Lal
June	Disease management in high hills and Harvesting of potato in mid hills of HP	Dr. Sanjeev Sharma Dr. Dhiraj K. Singh
	Topics (AIR, Shimla)	
June	Live Phone in Programme on "Disease Management in Potato	Dr Sanjeev Sharma
June	Recording of Radio Talk on " Late blight disease and its management"	Dr Sanjeev Sharma Dr NK Pandey

Human Resource

Joining

1. Dr. (Mrs.) Alka Joshi, Scientist (Food Tech.) joined at CPRI, Shimla (on selection) on 07.04.2014.
2. Dr. (Ms.) Tanuja Buckseth, Scientist (Vegetable Science) joined at CPRI, Shimla (on selection) on 07.04.2014.
3. Dr. Rajendra Singh, Sr. Scientist (Genetics and Plant Breeding) joined at CPRI, Shimla (on selection)on 16th April, 2014
4. Dr. Prince Kumar, Scientist (Veg. Sci.) joined at CPRS, Jalandhar (on selection) on 03.04.2014.
5. Dr. Raja Shankar, Sr. Scientist (Veg. Science) joined at CPRI, Shimla (on selection) on 26th May, 2014.
6. Dr. Som Dutt, Sr. Scientist (Plant Bio-chemistry) joined at CPRI, Shimla (on selection) on 31.05.2014.
7. Dr. Prashant G Kawar, Sr. Scientist (Genetics and Plant Breeding) joined at CPRI, Shimla (on selection) on 02.06.2014.
8. Dr. Jagdev Sharma, Principal Scientist (Soil Science) joined at CPRI, Shimla (on transfer) on 25.06.2014.

Promotions

Name	As	Date
Administrative		
Sh. Dhani Ram Asstt.	AAO, CPRI, Shimla	20.6.2014

Retirements

Name	Post	Retired on
Scientific		
Dr. MC Sood	Principal Scientist, CPRI, Shimla	30.4.2014
Dr. RK Verma	Principal Scientist, CPRIC, Modipuram	31.5.2014
Technical		
Sh. Surinder Paul	Tech. Officer, CPRI, Shimla	30.4.2014
Sh. Harbans Lal	Sr. Tech. Officer, CPRS, Jalandhar	30.4.2014
Sh. Ajay Vir Singh	Tech. Asstt., CPRIC, Modipuram	30.4.2014
Sh. Brij Mohan Lal	Tech. Officer	30.4.2014
Administrative		
Smt. Roseline	AAO, CPRI, Shimla	30.4.2014
Sh. Amar Singh	Asstt., CPRI, Shimla	30.4.2014
Sh. Praveen Chandla	Asstt. Director (OL), CPRI, Shimla	31.5.2014
Sh. HK Verma	Personal Secretary, CPRI, Shimla	31.5.2014
Sh. Dharam Das Kashyap	Asstt., CPRI, Shimla	30.6.2014

Tranfers

Name	Post		
Scientific		**From**	**To**
Dr. (Mrs.) Uma Maheshwari	Scientist (Nem.)	Ooty	IIHR, Bangalore
Dr. R Muthuraj	Sr. Scientist (Seed Tech.)	Shimla	CTCRI, Thiruvananthapuram
Administrative			
Sh. Sandeep Verma	UDC	Modipuram	Shimla

Untimely Demise

Name	Post	
Sh. Dhominik Mawkhlieng	CPRS, Shillong	11.5.2014
Sh. Ajmer Singh	CPRS, Gwalior	02.6.2014

Foreign Visits

Dr. Bir Pal, Singh, Director, CPRI, Shimla participated in the meeting of Board of Trustees of CIP held at Beijing, China during 14-18 April, 2014 .

Dr. Bir Pal, Singh, Director, CPRI, Shimla attended the "Regulatory Strategy Meeting" of ABSP-II LBR Potato Project held at Dhaka Bangladesh during 12-14 May, 2014.

Dr. Vinay Bhardwaj, Sr. Scientist, CPRI, Shimla attended the "Regulatory Strategy Meeting" of ABSP-II LBR Potato Project held at Dhaka Bangladesh during 12-14 May, 2014.

Dr. Sanjeev Sharma, Sr. Scientist, CPRI, Shimla attended the "Regulatory Strategy Meeting" of ABSP-II LBR Potato Project held at Dhaka, Bangladesh during 12-14 May, 2014.

Dr. Sundaresha, Scientist, CPRI, Shimla attended the "Regulatory Strategy Meeting" of ABSP-II LBR Potato Project held at Dhaka, Bangladesh during 12-14 May, 2014.

Awards

Dr. SP Singh, Principal Scientist, CPRS, Gwalior bagged Best Oral Paper Presentation Award during Global Conference on Technological Challenges and Human Resources for Climate Smart Horticulture held at NAU, Navsari, Gujrat.

Dr. Pinky Raigond, Scientist, CPRI, Shimla bagged Best Oral Paper Presentation Award during Global Conference on Technological Challenges and Human Resources for Climate Smart Horticulture held at NAU, Navsari, Gujrat.

From the Director's Desk

Climate change is now considered the biggest threat to the survival of mankind. It is not merely an environmental problem, our food security is also at stakes due to climate change. As per the latest IPCC report (released in May 2014), each of the last three decades has been successively warmer at the Earth's surface than any preceding decade since 1850. Potato is an important food crop of India, only after rice and wheat in terms of production. We have made tremendous progress in potato production and the per capita availability of potato has increased from 4.37 kg in 1950 to 21.52 kg in 2012. However, the climate change is likely to have a negative effect on potato growth in India, including productivity, production and profitability. CO_2 concentration and assimilation are positively correlated and a 10% increase in tuber yield is estimated for every 100 ppm increase in CO_2 concentration due to increased photosynthesis by 10 to 40%. However, increase in CO_2 concentration causes increase in temperature, which has adverse effects on potato growth. Potato is largely grown during winter season in India, and is mainly confined to Indo-Gangetic plains. The autumn/winter planted crop in northern plains of India comprising the states of Uttar Pradesh, West Bengal, Bihar, Punjab and Haryana contributes 90% of total potato production in India. As per the IPCC 4th Assessment report, a greater increase in temperature is likely in this region compared to rest of India. Moreover, potato season is further likely to be warmer compared to other seasons in this region. This situation is likely to impact the availability of suitable growing period for potato in India seriously. Modelling studies have shown that although potato productivity is not likely to be affected in Punjab in future climates, as the change in productivity is likely to be between +3.3 to +3.6% in 2020 and + 0.1 to - 1.9% in 2055, it can go down by up to 7.0% in 2020 and 13.4% in 2055 in Uttar Pradesh. Overall in India, a decline in production from the current levels by 3.16 and 13.72 % is expected in the year 2020 and 2050, respectively. Punjab and western Uttar Pradesh are two major states which supply the potato seed to rest of the country owing to longer crop duration as well as aphid free period available for producing quality potato seed. In case of climate change scenario, the temperature change is likely to affect the late blight outbreak in Punjab and western Uttar Pradesh, thus affecting the potato seed production. Modelling studies using JHULSACAST have shown that in Punjab, although late blight appearance is expected to be delayed under climate change scenarios, the duration of late blight favourable period is likely to increase which will require more number of sprays to control this disease which will ultimately result in poor quality and higher cost of seed. A warmer climate will experience additional life cycles of certain insects per season, early appearance of aphids with higher population and activity is also likely. All these factors put together are likely to negatively impact the potato production in India. There is an urgent need to address the challenges posed by climate change. Breeding short duration and heat tolerant cultivars should be the priority of our research. Mining biodiversity to heat tolerance shall be taken up on priority. Research should be strengthened on further development of agro-techniques for warm weather cultivation and work should be done in potato based cropping systems for developing improved agronomic management, particularly for water and fertilizer use efficiency. The new areas should be identified for ware and seed potato production. We should further strengthen education, research and development in warm climate production technology for ware and seed potato crop. This is not a comprehensive list but only a few indicative steps which need immediate attention for sustained livelihood and nutritional security through potato.

Compiled and edited by : Brajesh Singh, Vinay Bhardwaj, Dhiraj K. Singh and R.M. Sharma

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