Phytogen March 2017

Sambasivam Periyannan – 2016 ASPS Peter Goldacre Award recipient shares his story of success

09 March 2017

SECURING GLOBAL FOOD PRODUCTION BY

RAPID ISOLATION OF WHEAT RUST DISEASE RESISTANCE GENES

Born and raised among the tropical plants on a small farm in Southern India, I never dreamed of becoming a researcher instead of a farmer. With a Master's in Plant Pathology and a short exposure to the management of diseases in horticultural crops, in 2007, I had the opportunity to migrate to Australia to undertake a PhD at Plant Breeding Institute (PBI), University of Sydney. Until the time, I didn't realise that PBI is the pioneering centre for fundamental studies on plant-pathogen interactions. With the outbreak of the deadly stem rust fungus Ug99 in East Africa, my PhD project was specifically focused on the molecular genetics of wheat stem rust resistance. At PBI, I was working with Drs Harbans Bariana and Urmil Bansal who are world renowned expertise in identifying and charateristing novel rust resistance genes in wheat. With a year of training on rust pathogenicity, in 2008, I moved to Dr Evans Lagudah's lab at CSIRO, Canberra to continue the project towards rust resistance gene cloning. I was so excited to join Evan's lab as it is one among the very few labs of the world which are successful in cloning rust disease resistance genes from the complex wheat genome. Given the complex nature of the wheat genome, it was a challenging project for PhD training. But with emergence of Ug99 as a major threat to global food security, I was highly motivated to succeed and I cloned the first stem rust resistance gene *Sr33* from wheat. Further enthusiasm came when the results were published in **Science** (with cover page highlights) capturing the attention of several media outlets including BBC news (http://www.bbc.com/news/science-environment-23084782).



During that time, I realised that the wheat and the plant science community as a whole was in need of a robust method for isolating disease resistance genes as the conventional map-based gene cloning was tedious and time consuming. Using the resources of *Sr33* and in collaboration with Drs Brande Wulff (at John Innes Centre) and Jonathan Jones' lab (The Sainsbury Laboratory) at Norwich (UK), a rapid resistance gene cloning tool called "Mutagenesis and Resistance gene enrichment and Sequencing (MutRenSeq)" was developed to identify resistance genes within two years, whilst the map-based approach on average requires five years. This new technology was further validated by the successful isolation of two additional stem rust resistance genes, *Sr22* and *Sr45,* which like *Sr33,* were effective against Ug99 and other wheat stem rust races. Along with the publication of this method in **Nature Biotechnology** (as a cover page article), the technique holds a patent in the USA. Apart from wheat, this robust gene cloning technique is currently being extended to other agricultural crops such as barley, soybean, potato, tomato and rye.

With the above achievements, I was fortunate to win the prestigious ASPS "Peter Goldacre Award". This award contributed to my success in winning a highly competitive Australian Research Council "Discovery Early Career Researcher Award". My gratitude for both awards has fuelled my hunger for future research success, where I am now identifying the signalling elements and molecular pathways of the cloned rust resistance genes in pathogen infected wheat. As plant pathogens evolve rapidly and become a major problem for securing food production and sustainable agriculture, knowledge of disease resistance gene function is required to help innovate a new generation of robust crops with durable resistance to multiple pathogen varieties.

I would like to acknowledge Sydney University, ACIAR, Durable Rust Resistance in Wheat project and Grains Research and Development Corporation for the scholarship and the research grant

to undertake the aforementioend studies. Finally, I thank Drs TJ Higgins, Jeff Ellis and Evans Lagudah at CSIRO for nominating me for the prestigous ASPS Goldacre Award.

Email: Sambasivam.Periyannan@csiro.au

References:

1. Steuernagel B[#], **Periyannan S[#]**, Hernandez-Pinzon I, Witek K, Rouse M, Yu G, Hatta A, Ayliffe M, Bariana H, Jones J, Lagudah E, Wulff B (2016). Rapid cloning of disease-resistance genes in plants using mutagenesis and sequence capture. ***Nature Biotechnology*** 34:652-655 (*[#]joint first author*)
2. **Periyannan S**, Moore J, Ayliffe M, Bansal U, Wang X, Huang L, Deal K, Luo M, Kong X, Bariana H, Mago R, McIntosh R, Dodds P, Dvorak J, Lagudah E(2013).The gene *Sr33*, an ortholog of barley *Mla* genes, encodes resistance to wheat stem rust race Ug99. ***Science*** 341:786-788.

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As always, if you have any plant science events, news, reports or information that you would like us to help promote and share with the global community, then please do get in touch! Contact Lisa, GPC's Outreach & Communications Manager: lisa@globalplantcouncil.org.

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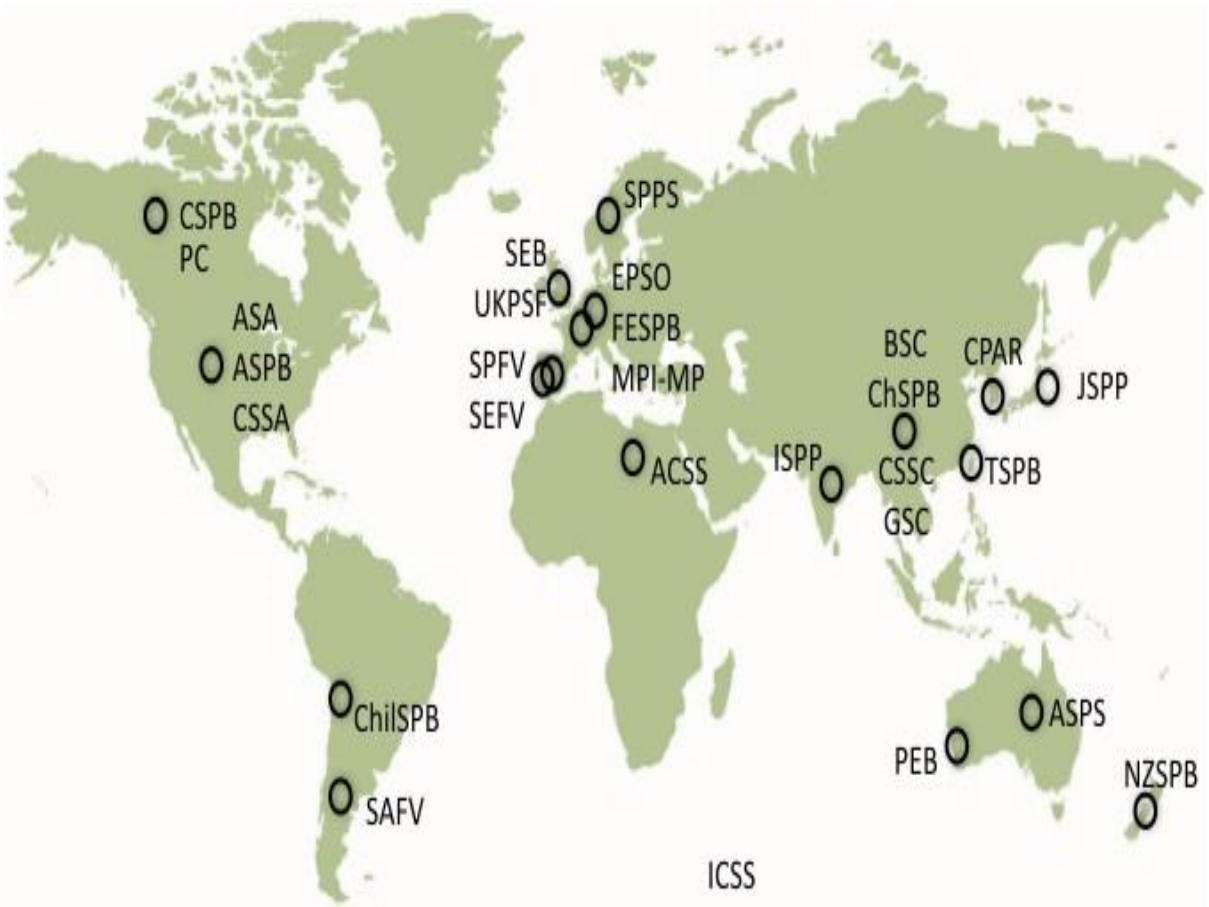
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Please contact Ruth Bastow (ruth@globalplantcouncil.org) to find out how your organization can join the Global Plant Council.



The GPC is a coalition of plant and crop science societies and affiliates from across the globe. The GPC seeks to bring plant scientists together to work synergistically toward solving the pressing problems we face.

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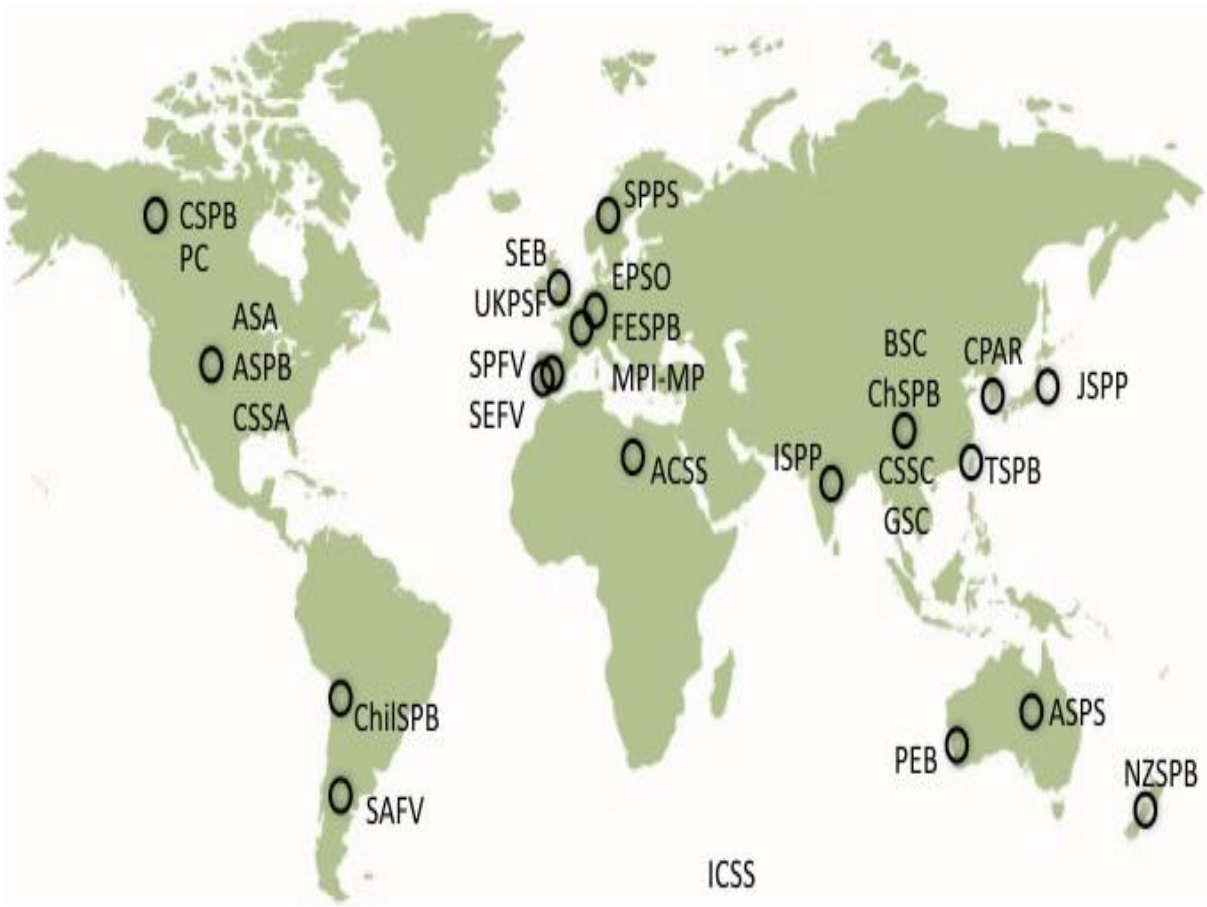
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Dear ASPS member,

Entries and nominations are now open for the 2017 Australian Museum Eureka Prizes.

We are hoping you can help us reward great Australian science by promoting the following opportunities to your networks. Please read on for more information as well as some options for promotional blurbs you might be able to use in your internal and external communications, newsletters, website or social media.

There are 15 prizes on offer this year including one NEW prize:

Research & Innovation

- NSW Office of Environment and Heritage Eureka Prize for Environmental Research
- University of Technology Sydney Eureka Prize for Excellence in Data Science ****NEW****
- UNSW Eureka Prize for Excellence in Interdisciplinary Scientific Research
- Australian Infectious Diseases Research Centre Eureka Prize for Infectious Diseases Research
- Johnson & Johnson Eureka Prize for Innovation in Medical Research
- ANSTO Eureka Prize for Innovative Use of Technology
- Defence Science and Technology Eureka Prize for Outstanding Science in Safeguarding Australia
- Macquarie University Eureka Prize for Outstanding Early Career Researcher
- UNSW Eureka Prize for Scientific Research

Leadership

- 3M Eureka Prize for Emerging Leader in Science
- CSIRO Eureka Prize for Leadership in Innovation and Science
- University of Technology Sydney Eureka Prize for Outstanding Mentor of Young Researchers

Science Engagement

- Department of Industry, Innovation and Science Eureka Prize for Innovation in Citizen Science
- Department of Industry, Innovation and Science Eureka Prize for Science Journalism

School Science

- University of Sydney Sleek Geeks Science Eureka Prize (Primary and Secondary School)

Key dates

Friday 10 February Entries open

7 pm AEST Friday 5 May Entries close

Friday 28 July Finalists announced

Wednesday 30 August Winners announced