2nd COST IPLANTA TRAINING SCHOOL

CA15223

‘RNAi applications; from lab to field’

Rothamsted Research

Harpenden, UK

27th - 28th Sept 2018

The aim of the 2nd iPlanta Training School is to provide training and best-practice in the practical aspects of conducting field-based RNAi research for improved crops. It will consider case-studies from experienced researchers for insect- fungal- and viral-resistance applications of RNAi. It will also describe the current EU GMO regulatory landscape and provide training in the preparation of applications for Part B, non-commercial GM field trials. It will give trainees the opportunity to see cutting-edge contained use glasshouses, growth rooms and the Rothamsted field trial site and to hear from farm and glasshouse managers who have experience in dealing with contained use and field-based GM experimentation. High qualified trainers from iPLANTA network will be invited.

All scientists/researchers/experts of the biotechnology area are eligible to submit application for the iPLANTA grants, in the selection a priority will be given to Early Career Investigators (ECIs) and to the qualification of the curriculum. Grant applications should be made using the appropriate application forms in the Training School area (at : http://iplanta.univpm.it/node/6) before 31 July 2018. Unselected trainees can attend the school at their own expense.

Wed 26th Sept

Optional participation in iPlanta WG2 meeting all day. However, you must still register to attend the WG2 meeting.

Thursday 27th Sept 09.00 -17.30

09.00 – 09.15 Welcome and introductions Huw Jones

09.15 – 09.45 RNAi-based biopesticides: Status and challenges in insect pest control Guy Smagghe (Gent University)

Case studies of current RNAi research applications

09.45 – 10.15 RNAi strategies for inducing pest and disease resistance in fruit crops. Bruno Mezzetti (Università Politecnica delle Marche, Italy)

10.15 – 10.45 RNAi/entomo-pathogenic fungi & bee biosafety. Martin Edwards (Newcastle University, UK)

10.45 – 11.15 Coffee

11.15 – 11.45 VIGS/HIGS in wheat. Vinay Panwar, Kostya Kanyuka & Kim Hammond-Kosack (Rothamsted Research, UK)

11.45 – 12.15 RNAi-based in planta applications for insect pest control. Clauvis N. T. Taning, (Ghent University, Ghent, Belgium).

12.15 – 12.45 Omega-3 LCPUFA fish oils in Camelina. Johnathan Napier (Rothamsted Research, UK)

12.45 – 13.45 Lunch

Guided tours of Labs and GM field trial site.

14.00 – 15.00 tour of tissue culture and molecular biology labs and description of the various steps of the wheat transformation process from DNA delivery to the selection /testing of transgenic lines. Caroline Sparks (Rothamsted Research, UK)

15.00 – 16.00 tour of GM glasshouse and CE facilities Fiona Gilzean (Rothamsted Research, UK)

16.00 – 17.30 tour of GM field site, Stephen Goward. (Farm Manager Rothamsted Research, UK)

Friday 28th Sept. 09.00 – 12.30

Challenges of translating research from lab to field

09.00 – 09.30 Managing GM Camelina field trials in UK and USA Lihua Han (Rothamsted Research, UK)

09.30 – 10.00 Managing the media and communications Matina Tsalavouta (University of Liverpool, UK)

10.00 – 10.30 GM, RNAi and CRISPR – an EU perspective (Hilde-Gunn Opsahl Sorteburg (Norwegian University of Life Sciences, Norway)

10.30 – 11.00 Coffee.

11.00 – 11.30 Environmental risk assessment for experimental releases, Jeremy Sweet Independent consultant)

11.30 – 12.00 Title and speaker TBC

12.00 – 12.30 Distinctions between 2001/18 Part B and C applications Huw Jones (Aberystwyth University, UK)

12.30 Close

Trainers' Abstracts.

RNAi-based biopesticides: Status and challenges in insect pest control

Guy Smagghe (guy.smagghe@ugent.be), Ghent University, Ghent, Belgium

Over the past decade, RNA interference (RNAi), the sequence-specific suppression of gene expression triggered by specific dsRNA molecules, has proven to be a very promising strategy in crop protection. The main advantages of RNAi are its selectivity, as well as the lack of persistency in and damage on the environment as a whole. In this paper, we report on the promising results against pest insects such as the western corn rootworm *Diabrotica virgifera*. Also successes have been reported against other beetle pests as Colorado potato beetle, but also sucking pest insects as Asian citrus psyllids and mites. In addition, a number of

challenges will be discussed that needs to be addressed to implement RNAi as a widely-used pest control strategy. One of these challenges is a variable efficiency. While some insects show a very robust, efficient and systemic RNAi response, many others show a limited or variable RNAi response. Possible causes for this variability in sensitivity are degradation of the dsRNA in the insect body, insufficient uptake into the cells, viral interactions or problems with the RNAi machinery in the cells.

RNAi strategies for inducing pest and disease resistance in fruit crops
Bruno Mezzetti, Università Politecnica delle Marche, Italy

RNAi is a complementary technology that can switch on and off genes in plants and therefore remove gene products i.e. unwanted proteins like gluten or add/increase important nutrients such as Omega 3 fatty acids. The additional potential and unique capacity of Double-stranded RNAi technologies is to induce resistance to pests and pathogens. In fact, small RNAs (sRNAs) that mediate cross-kingdom RNAi in plant hosts represent a novel class of pathogen effectors that inhibit host immunity for successful infection. e.g. sRNA trafficking from fungal/virus/bacteria pathogens and pests to host plants. Plant transgene-derived artificial sRNAs can induce gene silencing in certain interacting pests and pathogens, a phenomenon called host-induced gene silencing (HIGS). The use of RNAi technology, bidirectional cross-kingdom RNAi and two-way sRNA trafficking between pests/pathogens and hosts can offer new options in plant protection both with the production of new transgenic plants and the creation of new RNAi based products that can be applied on plants with a very target specific effect on pest and diseases. Virus resistant cultivars of papaya and plum obtained with gene silencing technology are currently available on the market. The new knowledge available from the studies of host and pathogen interaction offer the possibility of using the same technology to induce resistance to different pathogens important for fruit and vegetable productions. Opportunities offered by this technology in developing new defense strategies for the horticulture sector, will be discussed.

Environmental risk assessment for experimental releases
Jeremy Sweet
JT Environmental Consultants Ltd , Cambridge CB24 5JA, UK

Experimental field trials are considered as experimental releases which potentially provide full environmental exposure of the GM plant, but not food/feed exposure. Therefore the environmental risk assessment (ERA) has to consider all non-food/feed hazards and exposure routes associated with the GM crop and perform a risk assessment accordingly. The field trial design and location will influence the ERA and the outcome of the risk assessment will indicate measures to be taken to limit exposure to the immediate vicinity of the field trail area. These include isolation measures for restricting plant and propagule movement in order to minimise gene flow, and post-harvest destruction of all materials. The ERA will also indicate monitoring requirements before, during and after the field study and provide the scientific rationale for the emergency plan. The ERA is submitted to the Competent Authority together with the other information required for a Part B release. Conditions for the experimental release set by the CA will reflect the outcomes of the ERA.

GM, RNAi and CRISPR – an EU perspective
Hilde-Gunn Opsahl Sorteburg, Norwegian University of Life Sciences, Norway

GM, RNAi products and CRISPR from a legislative and research perspective respectively. How this might affect Europe`s food security and our way forward. Ways to communicate plant research to the people will also be included.

RNAi-based *in planta* applications for insect pest control

Clauvis N. T. Taning (tiziclauvis.taningnji@ugent.be), Ghent University, Ghent, Belgium

Over the past decades, scientists have made tremendous progress in understanding and unravelling several aspects of double-stranded RNA (dsRNA)-mediated gene silencing. Now that the RNA interference (RNAi) mechanism is well understood, it is time to consider how to apply the acquired knowledge to agriculture and crop protection. *In planta* RNAi against essential insect genes offers a promising route to control insect crop pests. In this report, we present and discuss various successful stories of *in planta* RNAi and its potential in the control of insect pests. Furthermore, we also present and discuss some potential challenges in the application of *in planta* RNAi.

Distinctions between 2001/18 Part B and C applications

Huw Jones (Aberystwyth University, UK)

Applications for the so called EC 2001/18 'Part B' research field trials are made to the competent authority of the member state where the trials will be held. There are also significant differences between the data package required for part B and commercial part C applications. This presentation will complement others in the Training School that describe the information needed for part B applications.