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Information that DSS builders can find in the Eucablight database

L.T. COLON[1] , D.E.L. COOKE[2], J. GRØNBECH-HANSEN[3], P. LASSEN[3], G. KESSEL[1] AND A.K. LEES[2]

[1] Plant Research International, PO Box 16, 6700 AA Wageningen, the Netherlands

[2] Scottish Crop Research Institute, Invergowrie, Dundee DD2 5DA, United Kingdom

[3] Danish Institute of Agricultural Sciences, Department of Agroecology, Research Centre Foulum, 8830 Tjele, Denmark

Summary

The pan-European Concerted Action on late blight 'Eucablight' was set up and launched in 2003, with the aim of providing tools for investigating variation in both the host and the pathogen. Objectives include the construction of a database, (www.Eucablight.org) containing information on past and current potato cultivars and late blight populations available in the participating countries, and the design, testing and recommendation of protocols for testing host resistance and pathogen diversity. The database is structured, and made accessible, in such a way that DSS builders can access the model parameters they need to construct locally adapted forecasting systems.

Keywords: *Phytophthora infestans*, late blight, resistance, pathogen population

Introduction

Integrated strategies for the control of potato late blight using reduced fungicide inputs require reliable information about the aggressiveness of the late blight population and the level and stability of resistance in the potato cultivars in the region. The current European data on pathogen aggressiveness and host resistance are fragmented and the methods used to collect this data are often not well documented.

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The Eucablight project, a concerted action funded by the European Union, is undertaking to improve this situation. It will collate the available data into a harmonised and readily accessible database which will assist the construction of Decision Support Systems.

The Eucablight project started in February 2003 and will run for three years. Eucablight includes 24 member institutions from EU countries and representatives from several non-EU countries. It operates on both a thematic (host or pathogen) and a regional basis. This dual structure favors interactions between members. Objectives include the construction of a database containing reliable information available in participating countries on late blight populations and past and current potato cultivars, and the design, testing and recommendation of protocols for testing pathogen diversity and host resistance.

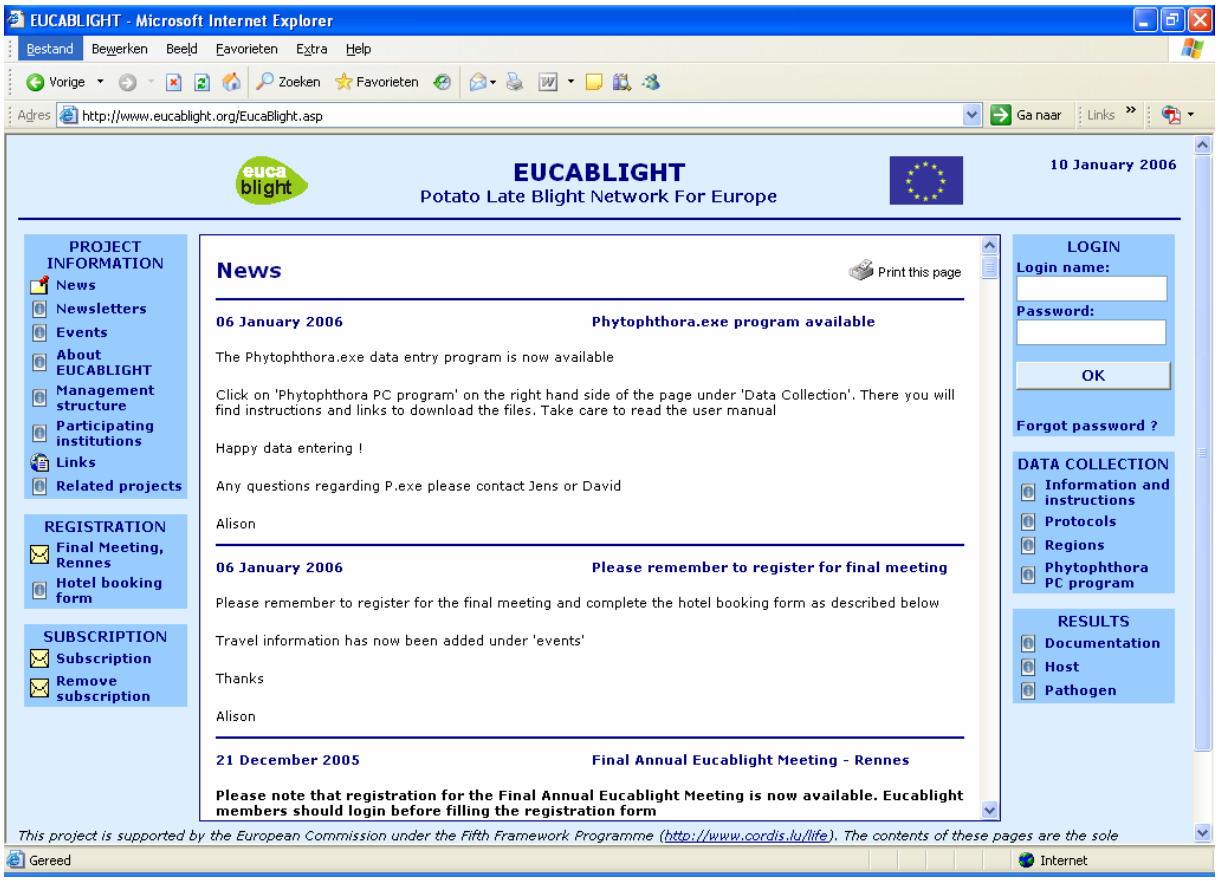

Figure 1. Homepage of www.eucablight.org.

The database

The database (www.Eucablight.org) has been created, and is hosted, by the Danish Institute of Agricultural Sciences (DIAS) at Foulum, Denmark. The technical details of the database are described by Lassen & Hansen (2005). The information in the database consists of

phenotypic data from a number of late blight strains and potato cultivars. All the information is associated with specific years and geographic areas, allowing direct comparisons of specific pathogen events (introduction of a new genotype of the pathogen) to specific host events (e.g. breaking of a new resistance gene).

The data can readily be enriched by new entries using two specially designed software programs, Phytophthora.exe and Cultivar.exe, developed by the project.

An important characteristic of the database is that the data contributed (primary data) can only be viewed directly, or retrieved by the contributors themselves. This will ensure that the copyright of the original data remains with the contributor. Both the host and pathogen data will be processed into secondary variables and displayed on the website as tables, graphs and maps. Examples are frequency of metalaxyl sensitivity or area under the disease progress curve (AUDPC). This will provide synthetic overviews of the diversity of the pathogen population, the resistance of the cultivars and their distribution in time and space across Europe. The displays, automatically updated when new data are added to the database, will be made available to Eucablight members and non members through the Eucablight website.

The database was built in 2003 and the first data were entered in 2004. Encouragingly, there were also contributions from outside the Eucablight consortium, which indicates that the concept appeals to the scientific community. In 2005, the collection of data was continued and efforts were concentrated on the outputs that will be made available on the website. This required a number of choices to be made relating to statistics and to the disease models used to transfer the disease readings into secondary variables. To date, the database contains over 4 000 potato cultivar entries and 13 000 pathogen entries from countries across the whole of Europe.

Protocols

Protocols for assessing biological, pathogenic and genetic diversity vary between laboratories engaged in host resistance and population analyses of *P. infestans* worldwide, but also in Europe. These differences make the comparison of data collected by different teams difficult, and sometimes downright impossible. Furthermore, technologies for the analysis of genetic and phenotypic diversity evolve rapidly. Therefore, one of the main objectives of Eucablight is to collate, formalise, assess and recommend the most suitable protocols, through the collective work of its members. These protocols are available through a dedicated section of

the Eucablight website, and formed the basis of training courses available to both members and non-members. The overall aim is to provide reliable, standardised methodologies generating readily comparable data, and to facilitate the use and adoption of improved protocols for future work. The protocols were compiled by members of the 'host' and 'pathogen' technical groups of Eucablight, and discussed during project meetings before validation as 'Eucablight Recommended protocols'.

Pathogen data

The pathogen data in the Eucablight database mainly represent isolates collected since 1990, and contain both phenotypic (e.g. mating type, phenylamide resistance, virulence) and genotypic (e.g. isozymes, mtDNA fingerprints, SSR alleles) information. The database is designed to accommodate new markers as these become widely available.

The reliability of virulence tests has been questioned repeatedly, and Eucablight has therefore designed experimental validation trials in the form of blind ring tests. The virulence ring test involves 10-12 laboratories within the Eucablight Consortium who, in 2005, tested ten coded isolates according to an agreed protocol and on the same set of differential clones (provided in 2004 by SASA).

A small core collection of isolates, characterised for most or all of the traits entered in the database, was compiled from donations received from the existing collections of Eucablight participants and is maintained as reference material by SCRI. The purpose of this core collection is to serve as a set of controls for laboratories wishing to calibrate and operate a technology, as well as a set of reference genotypes with which to develop new technologies.

These Eucablight activities will be valuable for the description, analysis and understanding of the evolution of *P. infestans* populations in Europe, and thus aid both current and future strategies for late blight control.

Host data

The Eucablight database contains resistance data from trials that include seven standard cultivars and which have been scored using standard disease assessment methods. The standard cultivars have been chosen on the basis of their availability and the expected durability of the resistance, and represent the extremes of susceptibility and resistance in the three maturity classes 'first early' (Eersteling and Gloria), 'maincrop' (Bintje and Escort) and

'late' (Alpha and Robijn). Sarpo Mira, was added as a representative of the highest resistance class, although the durability of its resistance has yet to be established. To facilitate the dissemination of the seven standards, they have been distributed as seed potatoes and are also being made available from the Scottish Agricultural Science Agency (SASA) in East Craigs as *in vitro* cultures. In addition to these standards, the inclusion of SASA's 11 single R gene differentials R1 – R11 in the trials is also recommended to ensure that high resistance scores are not due to a simple pathogen race structure.

A requirement of the trials is the use of standard protocols to carry out resistance assessments. Protocols for foliage and tuber resistance include a field trial, a detached leaflet assay and a whole plant glasshouse assay, and a field trial, a whole tuber lab test and tuber slice lab test, respectively. A protocol relating to plant maturity is also available, since this trait is highly correlated with resistance to late blight in the foliage. All protocols and other information are available as Pdf documents at www.Eucablight.org.

In order to allow monitoring of the resistance of a cultivar from the time of first selection, the database contains data from both cultivars and breeding lines. A database containing details of more than 4 000 cultivars will help to link the identities of breeding lines to cultivars, and to avoid duplicated entries due to misspellings. This section of the Eucablight database also contains data relating to presence of R genes, fertility, use (ware, processing or starch) and ploidy level of the germplasm, collated from published and unpublished sources.

Data that can be used for Decision Support Systems

Region-specific parameters required for DSS both for pathogen and host, can be derived from the database.

For the pathogen, useful parameters are:

- Mating type. The occurrence of both A1 and A2 mating types in the area in recent years indicates if there is a chance of oospores, and a need for early fungicide treatments if water logging of the soil occurs;
- Metalaxyl resistance, indicating if metalaxyl can be used;
- Virulence, in order to select those varieties with R genes functioning against the prevailing pathogen population.

For the host:

- Disease curves and number of days till the first symptoms appear, which can be used to predict the expected start of epidemic of specific varieties once blight has appeared in the area;
- Delta a and delta t. These parameters indicate for a specific variety if the disease appears early or progresses slowly relative to the susceptible variety Bintje. From this information the risk of resistance breakdown in the area can be estimated (Andrivon et al, 2004);
- Apparent infection rate and 1-9 scale values for foliage resistance. From these parameters can be estimated if reduced fungicide dosage is possible, usually if foliage score is higher than 7;
- Infection resistance of tubers, relevant for spraying schemes after onset of tuberization;
- Tuber flesh resistance (should be low so infected tubers disappear).

Conclusion

A particular advantage of the Eucablight database is that it generates region-specific information on host resistance and pathogen characteristics that are required as parameters in DSS. This makes the database an important instrument to follow the co-evolution of host and pathogen in Europe and inform the use of appropriate resistance genes and control measures. New contributors are welcome and can contact Alison Lees at alees@scri.ac.uk.

Acknowledgement

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