

EuroBlight in a global context

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In the previous International Conference on Late Blight in Beijing, 2008¹, there was clear interest in greater coordination among late blight (LB) workers in the developing world. This was recognized as a general mechanism for improving LB research and for reducing the duplication of efforts that was evident from some of the presentations. It seems logical that this unfortunate situation where efforts are duplicated can occur if communication among researchers is limited.

In the previous EuroBlight meeting in Hamar, Norway, there was a stated interest in expanding EuroBlight technologies to other parts of the world; which, I believe, stemmed in large part from a realization of the benefits these technologies could provide. The idea of expanding EuroBlight's influence was also evident in an international meeting held in Bellagio, Italy in Nov, 2009¹. The meeting was focused on a global solution to the LB problem and many Europeans were present, as were participants from developing countries. There was active discussion about the use of Euroblight services and technology in the developing world. Below, I discuss some of the mechanisms by which this globalization of the EuroBlight approach could occur.

A white paper was published as a result of the Bellagio meeting that identified five major areas where more work is needed to reduce the devastating effects of this disease (Table 1).

PATHOGEN MONITORING

One of the areas identified in Bellagio was that of pathogen monitoring; certainly one of the primary EuroBlight technologies that could be globalized is the package of data management tools for pathogen monitoring, particularly the data input tool *Phytophthora.exe* (Hansen 2007; Hansen *et al.*, 2008), the common pathogen database and the data processing tools on the Euroblight Web page (www.euroblight.net). This suite of technologies has taken an interesting turn recently and is actually being globalized, but not yet in the context of potato late blight. The technology attracted the attention of the FAO and the Borlaug Global Rust Initiative² and is being adapted for that endeavor. Thus, EuroBlight technology will be successfully expanded first for cereal rusts and hopefully later for LB.

There is a need to be clear about the benefits of pathogen monitoring in developing countries to support and orient the use of these technologies.

1 More information is available at the GILB web page:
<https://research.cip.cgiar.org/confluence/display/GILBWEB/Home>

2 <http://www.globalrust.org/traction/permalink/about2>

In the developing world, knowledge of the pathogen population might not be related so much to DSS as in Europe, where there are highly structured and sophisticated DSS, both from public and private sectors; knowledge of the pathogen population can be used to refine these DSS. However in the developing world, DSS of this type don't exist and probably won't for some time, at least for small-scale farmers. This is particularly true in the case of LB, which occurs in many highland areas in the tropics, which are topographically and climatically complex - environmental conditions are highly variable within small geographic areas.

Aside from DSS refinement, there are important potential benefits to global pathogen monitoring. I discuss a few here:

Explaining and anticipating change.

One good example of this is in sub-Saharan Africa. Several studies have documented that there is only one clonal population of this is in sub-Saharan Africa. Several studies have documented that there is only one clonal population of *P. infestans* in the region, which is the US-1 "old" population. This population has been suspected of being less problematic for disease management than the new ones (see William E. Fry *et al.* 2009), which has been evidenced by the rapid displacement of US-1 by the new populations, and after displacement, an increase in fungicide needs and earlier disease initiation.

Interpreting research results.

Knowledge on the pathogen population may also help explain apparent discrepancies in results. Again for SSA, workers have been confused by the relative low numbers of fungicide applications used in SSA by farmers for disease control under conditions that would appear to be ideal for disease development - farmers often get away with 3-5 applications. This example of an apparent discrepancy is related to field-level disease management, but interpretation problems can also arise for large scale (GIS based) risk assessments, which use number of fungicide applications as an indicator variable (Sparks, Garrett, and G. A. Forbes 2009; Hijmans, G. A. Forbes, and Walker 2000). We have done a simulation exercise which showed that one would expect to use more fungicides to control disease in SSA than is actually being used by farmers (G. A. Forbes, Shtienberg, and Mizubuti 2009).

Anticipating durability of host resistance.

Another application of pathogen monitoring is in the study of the host-pathogen interaction. In the case where a cultivar is released as resistant (generally the case in a LB prone area), host monitoring can help explain any loss in resistance due to pathogen population change. By monitoring new cultivars, isolates can be collected from disease foci and compared for pathogenicity against isolates from other sources. This leads to clearer ideas about selection within the population. If this type of monitoring were done more often, we would currently have a much better idea of the durability of resistance and this would help us be more strategic in deployment of resistance.

Currently there are several efforts to produce resistant cultivars via genetic modification. At the same time, molecular tools are being developed to screen pathogen populations for effectors, even at the allele level. These data can also be used to make more accurate estimates of risk of pathogenicity against the new cultivars in the target pathogen population.

Fungicide resistance.

Surveys have shown that the phenylamide fungicide metalaxyl is still widely used in the developing world. At the same time, a few studies of the pathogen population (see for example Vega-Sanchez *et al.* 2000) have demonstrated that large portions of the pathogen population are resistant to metalaxyl in the laboratory. It is not known if this lab-based resistance is indicative of what is happening in the field. Since most systemic fungicides are combined with contact fungicides, it is not always easy for a farmer to see that the efficacy of the systemic component has been reduced.

Sexual reproduction and oospore production.

There are few clear examples of sexual reproduction occurring regularly (or even irregularly) in developing countries. Sexual reproduction is now occurring in some areas of Europe, although factors explaining this are not clear. Until conditions which lead to sexual reproduction are better known, we must assume that it could occur anywhere, should compatible isolates be brought into contact. The epidemiological effects of sexual reproduction are also unknown, but potential effects include increased genetic complexity from recombination and/or increased inoculum sources resulting from soil born oospores. Vigilance on this aspect of the *P. infestans* biology is warranted.

DATA MANAGEMENT

The suite of technologies developed in Euroblight for data management could be used to improve LB research in developing countries (William E. Fry *et al.* 2009). The number of studies on pathogen populations has increased in recent years in developing countries which demonstrates that there is an increasing number of laboratories that collect and maintain isolates and assess isolates using one or more of the published makers (D. E. L. Cooke and Lees 2004). In fact, pathogen population studies represented one area where the need for greater coordination was identified in the Beijing meeting mentioned above. One way to improve coordination and standardization would be to use the data input tool *Phytophthora.exe* developed in the Eucablight project³. Once data are entered in *Phytophthora.exe* they can be uploaded to a common database for comparison across locations. EuroBlight has also developed a database for surveillance data, as well as on-line analysis and graphing tools for weather based late blight sub-models (Hansen *et al.* this proceedings)

SOCIAL CAPITAL AND COLLABORATION

Use of the technologies described above in the developing world would promote the formation of networks of potato workers (plant pathologists, breeders and agronomists). It appears that a likely structure for these networks would be at the regional level: sub-Saharan Africa, Latin America, S E Asia. Broader networks involving potato researchers existed in the past, with PRAPACE in Africa, PRACIPA in Asia and PROINPA in Latin America. Although the networks were quite popular with the participants, donors tired of the concept, and all were eventually dissolved. There now seems to be renewed interest in the networks and there are potato breeding networks in both East Asia and Latin America, although to date they are only focused on breeding and cultivar development. Regional networks would seem to make particular sense for pathogen studies as this would contribute to the development of large common data bases that eventually would enhance capacity for pathogen monitoring across large geographic areas. Finally the development of a community of researchers through a network would provide opportunities for exchange of knowledge of methodologies and the greater synergy of working in a team. Given the regional and sometimes global nature of migrations of this pathogen, large scale pathogen monitoring makes sense.

It would appear logical to merge networking efforts for pathogen studies with existing potato breeding networks for several reasons. First, in many developing countries, potato pathologists and potato breeders work closely together and are frequently in the same organization. Second, as noted above, as more is learned about host pathogen interaction, and the role of pathogen diversity in the expression and durability of host resistance, the more it makes sense to monitor pathogen evolution with respect to resistance, particularly the apparition and establishment of pathogen genotypes that may overcome major resistance genes.

There may be a number of other ways in which the EuroBlight experience can help with coordination

3 <http://www.eucablight.org>

in LB research in developing countries. For example, another area discussed in the Bellagio white paper is better information and knowledge management. EuroBlight's experience with their LB information/knowledge portal⁴ can help orient efforts to do this for developing countries. Likewise, the now long-standing experience of organizing meetings and documenting the proceedings can also help provide "lessons learned" for similar efforts elsewhere.

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Table 1. The 5 "Actions" identified in the late blight White Paper developed after the conference in Bellagio, Italy⁵

Get resistant cultivars to farmers
Improve farmer disease management capacity
Know the enemy and develop a community of skilled pathogen monitors
Develop ecologically-based approaches to control late blight
Coordinate and monitor progress

⁴ <http://www.euroblight.net>

⁵ More information at the conference Web site: <https://sites.google.com/site/bellagioblnov2009/>