

The Luxembourg database of trichothecene type B *F. graminearum* and *F. culmorum* producers

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Abstract:

Data specific to 486 strains belonging to *Fusarium graminearum* and *Fusarium culmorum* were manually collected from Luxembourg field monitoring campaigns between the year 2007 and 2013. It is of interest to store such data in a web-enabled advanced database to help in epidemiological studies. Hence, we describe the design and development of a *Fusarium* database added to the Luxembourg Microbial Culture Collection (LuxMCC™) web interface at the Luxembourg Institute of Science and Technology (LIST). The database has three main features: (1) filter search, (2) detailed viewer of isolate information, and (3) excel export function of the dataset. Information on fungal strains includes genetic chemotypes, data on selected agronomic factors and crop management issues with geographic localization. The database constitutes a rich source of data for addressing epidemiological issues related to these two species. It will be regularly updated with improved features for advancement and utility.

Availability: The database is available for free at <http://www.luxmcc.lu/collections/fusarium>

Keywords: Genetic chemotype, *Fusarium culmorum*, *Fusarium graminearum*, geo-localization, data integration

Background:

Fusarium graminearum [1] and *Fusarium culmorum* [2] are the most important toxigenic species found on wheat and barley as they produce trichothecene type B toxins, such as deoxynivalenol, nivalenol, 3-acetylated deoxynivalenol, 15-acetyldeoxynivalenol, fusarenon-X. These compounds have different levels of toxicity on humans and animals [3]. Methods for classifying the strains based on their toxigenic potential are available [4]. Understanding factors which influence the presence of a certain species or chemotype on cereals can have important impact on food safety for cereal production as the type of population found on the grains can predict the toxigenic risk [5]. Integration of agricultural information with localization data (climatological information) explains the prevalence of specific pathogen population on cereals [6] with direct implications on food safety. Therefore, it is of interest to develop a database for data describing the strains of *Fusarium* isolated in the cereals fields at Luxembourg. The database includes a dataset collected over a period of seven years (2007-2013) from Luxembourg. This dataset contains several novel strains of the species. Information on crop, previous crop, chemotype, species and GPS localization are made available and accessible.

Methodology:

Data collection

The information on each strain was collected during seven years of a campaign of *Fusarium* monitoring in Luxembourgish fields as described elsewhere [5-8]. Properties of a total of 468 strains are described including GPS coordinates where the infected plant material was sampled, crop from which the strain was isolated, previous crop, fungal species, genetic chemotype and corresponding literature for information on strain description. Data for a total of 154 *F. culmorum* and 314 *F. graminearum* strains are included in the database.

Database design

A standard database structure has been developed for systematic storage and management of data. Hence, a database was constructed using the collected dataset on each strain. Its platform for the web server was developed using PHP/Symfony2 environment and MySQL for data management. A web-enabled application was constructed to search for species features with a detailed view having relevant additional information that is comprehensive in nature. The database also provides a data download option to export the dataset in Microsoft™ excel format without prior user registration requirements. The information on strains is available for free access at the LuxMCC™ database.

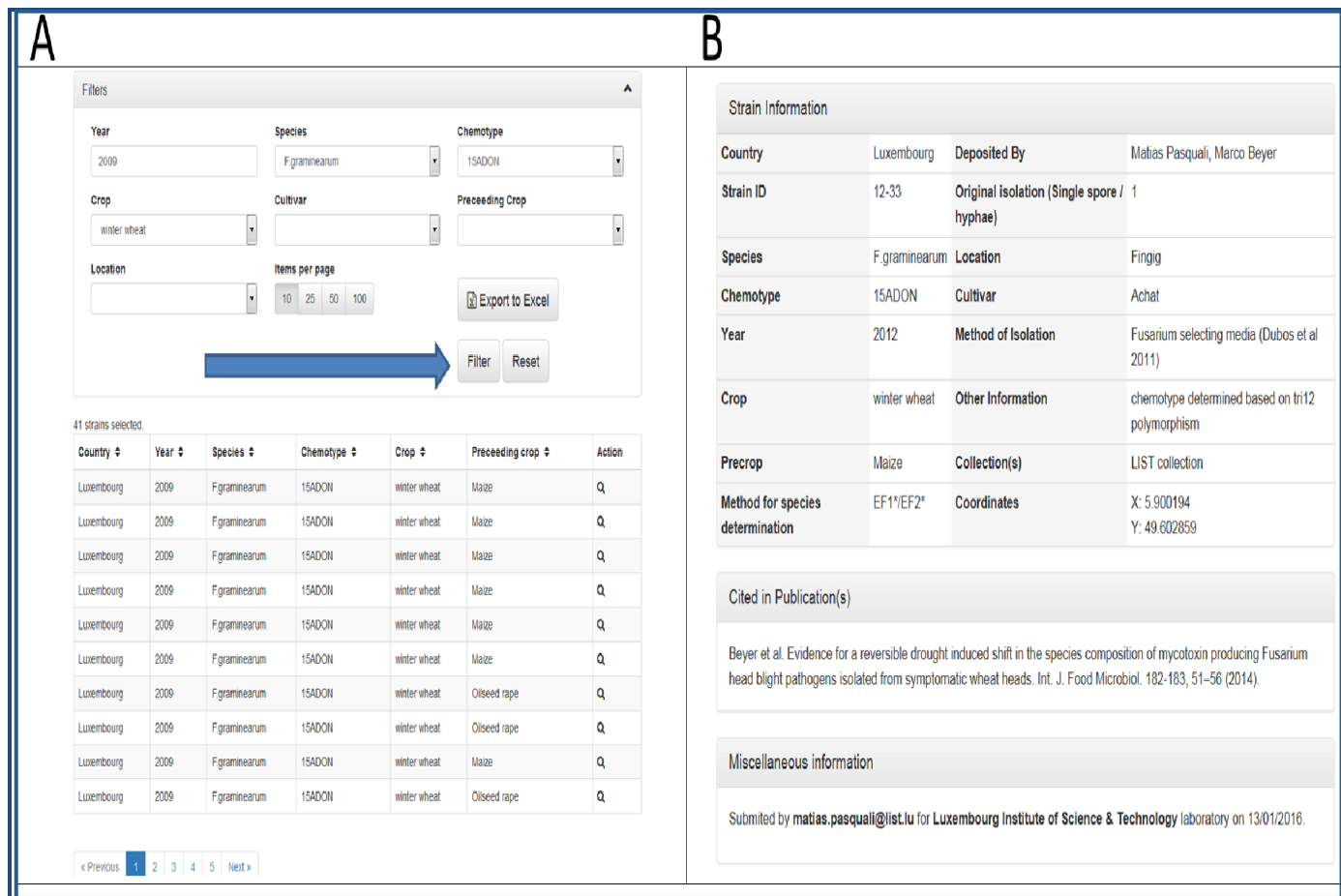


Figure 1: An illustration of the *Fusarium* database included in the Luxembourg Microbial Culture Collection (LuxMCCTM) is shown. (A) A view of the search page with filter options for year, species, chemotype, crop, cultivar, preceding crop and location is shown. The filtered dataset is exported by clicking the “Export to Excel” button marked by the blue arrow as shown in this panel. The complete dataset is exported when filters are not used. The “reset” button clears all applied filters to enable a new search. The “lens” hyperlink option (a mouse click is required) in the action column provides specific information for each strain. (B) An example of an information page for a specific strain data on its origin, genetic characteristics and characterization methods with appropriate literature citation are provided.

Implementations and features:

A search option using specific keywords is implemented in the web database. The database can be searched using keywords for year, genetic chemotype, species, crop with specific crop cultivar, previous crop and location (Figure 1A). The frequency of occurrence for each filtering set is displayed by the search interface. The user is also provided with an option to select the number of pages to be displayed.

The “+” option (mouse click) for each strain in the display page enables the user to access information on the species specific strain collection procedures, GPS data on strain source, strain characterization methods, sample collector (person name), data submitter (person name) and several other additional comments where appropriate (Figure 1B). The download option enables the user to export either the filtered dataset or the complete dataset in MicrosoftTM Excel format.

Utility, caveats and future developments:

The collected data on the *Fusarium* strains from Luxembourg are stored in a web-enabled database with advanced search features. This allows users to specifically search within the fungal collection of the Luxembourg Microbial Culture Collection (LuxMCCTM) database. The retrieved data provides the distribution of the species and chemotypes according to year and location for further epidemiological studies. We plan to continuously update the dataset with newly collected isolates obtained from ongoing *Fusarium* monitoring programs every year. The information retrieved from the database is useful in addressing critical epidemiological questions related to the spread of certain chemotype in the area. This facilitates the prediction of toxin contamination risks in grains due to certain predominant species in a specified sub-location within a region. Thus, the design and development of disease/toxin forecasting models is feasible.

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