

LES ACTIONS DE LA DGCD  
DGDC'S ACTIVITIES

DE ACTIVITEITEN VAN DE DGOS  
LAS ACTIVIDADES DEL DGCD

## ROYAL ACADEMY FOR OVERSEAS SCIENCES

### Yearly Competitions

Yearly competitions are organized by the three Sections – Moral and Political Sciences, Natural and Medical Sciences and Technical Sciences – of the Academy. Each of these Sections puts two questions forward on specific subjects, which makes a total of six topics open for competition.

All scientists worldwide, without any age restriction, are allowed to take part in the competitions, except for members of the Academy. Any study submitted to the yearly competitions should be an original, recent and unpublished scientific work, reaching at least the level of a PhD thesis.

Each award-winning work will be granted a prize of 1,000 EUR.

Pascale LEPOINT (Faculté d'ingénierie biologique, agronomique et environnementale, Université Catholique de Louvain) is one of the 2008 laureates for her study *Speciation within the African Coffee Pathogen*. An abstract of her work is presented below.

## Speciation within the African Coffee Pathogen

Pascale Lepoint

Ever since the late 1920s, coffee wilt disease (CWD) also known as tracheomyces or carbunculariosis has been causing significant losses in industrial *Coffea* spp. plantations as well as in traditionally kept gardens. The disease, endemic to the African continent, was first reported in 1927 in the Central African Republic (CAR, former Oubangui-Chari) on *C. excelsa*. Similar cases were subsequently reported on numerous *Coffea* spp. in the Democratic Republic of Congo (DRC), Côte d'Ivoire, Guinea (Conakry) and Ethiopia until severe control measures ended the coffee wilt reign in Central Africa in the late 1950s. However, once again, cases were observed in the 1980s in the Oriental province (DRC), rapidly spreading to neighbouring Uganda and Tanzania.

The main aim of this work was to gain a better understanding of the pathogen's sexual cycle and diversity as well as to determine the origin of its 're-emergence' in the Congo Basin region.

The heterothallic nature of *G. xylarioides sensu lato* (s.l.) was confirmed through *in vitro* crossing assays and mating type (MAT) PCRs, highlighting the presence of both mating types in each of the regions sampled. Compatible MAT-1 and MAT-2 strains are morphologically similar to Booth's 1971 female strain description. Primers designed in this study for the amplification of the MAT idiomorphs were successfully implemented to other members of the *Gibberella fujikuroi* species complex (GFC) and to *F. oxysporum*. The diversity of *G. xylarioides* s.l. in Africa was assessed using morphological, biological and phylogenetic tools before being extended to *G. indica* s.l., a close wilt-inducing relative. Both are nested within the GFC African clade.

Upon confrontation of results, it appears that what was previously circumscribed as a single species commonly termed '*G. xylarioides*', encompasses in reality four phylogenetically distinct and sexually incompatible species of which three are previously unrecognized taxa. *G. xylarioides* (*F. xylarioides*) is neotypified using *C. excelsa*-associated strains collected in the 1950s-1960s in the CAR. *G. xylarioides* is not responsible for the actual coffee wilt epidemics reported in the Congo Basin region or in Ethiopia which are caused, respectively, by *G. congoensis* (*F. congoensis*) sp. nov. and *G. abyssiniae* (*F. abyssiniae*) sp. nov. *F. guineensis* sp. nov., for which the teleomorph was not produced *in vitro*, is identified from *C. conep/jora*-associated strains isolated during the first outbreak in Guinea, Côte d'Ivoire and possibly CAR and is equally distinct from *G. xylarioides*. Both of these species have not been isolated in the past half century. Likewise, what was previously termed '*G. indica*' appears to contain several biogeographically and phylogenetically distinct species. Through the improved understanding of the mode of reproduction and the diversity of *G. xylarioides* s.l., new insights for resistance screening of coffee genotypes and disease management are provided.

## Symoens Prize for Tropical Limnology

In 1992 the Royal Academy for Overseas Sciences set up a fund for a triennial Prize of 2,500 EUR, named 'Jean-Jacques & Berthe Symoens Prize for Tropical Limnology', which is intended to reward a memoir of great scientific value on a subject related to tropical limnology.

The Prize has been awarded for the fifth time this year to Dr Hugo SARMENTO (Institut de Ciències del Mar, Dep. Biologia Marina i Oceanografia, Barcelona) for his study *Phytoplankton Ecology of Lake Kivu (Eastern Africa)*. An abstract of his work is presented below.

## Ecologie du phytoplancton du lac Kivu

H. Sarmento

Le lac Kivu a une origine volcanique. C'est un lac profond et méromictique, avec des caractéristiques limnologiques très particulières. Les données disponibles sur sa limnologie et ses communautés phytoplanctoniques sont limitées, dispersées ou anciennes. Pour une première fois, une étude approfondie et à long terme (2002-2004) sur la limnologie et l'écologie de phytoplancton du lac Kivu a été menée, combinant différentes techniques: analyse en HPLC des pigments marqueurs, cytométrie de flux, microscopie optique, en épifluorescence et électronique à balayage. Le lac Kivu combine une zone euphotique relativement peu profonde (-18 m), habituellement inférieure à la zone de mélange (20-60 m), avec un gradient thermique faible dans le mixolimnion. Avec une moyenne annuelle de chlorophylle a dans la zone de mélange de  $2.2 \text{ mg m}^{-3}$  et des concentrations en nutriments dans la zone euphotique faible, ce lac est clairement oligotrophe. En ce qui concerne sa composition phytoplanctonique, les espèces les plus communes rencontrées ont été les diatomées pennées *Nitzschia bacata* Hust. et *Fragilaria danica* (Kütz.) Lange-Bert, et les cyanobactéries *Planktolyngbya limnetica* (Lemm.) Komárková-Legnerová and Cronberg et *Synechococcus* sp. Les diatomées ont dominé le peuplement, en particulier pendant les épisodes de mélange profond durant la saison sèche. Pendant la saison des pluies, la colonne d'eau est stratifiée et les conditions de lumière sont plus favorables, mais la disponibilité nutritive est moindre, ce qui favorise la dominance de cyanobactéries. Les concentrations cellulaires de picoplancton phototrophe riche en phycoérythrine et de bactéries hétérotrophes ont été constamment élevées. Les variations spatiales, saisonnières et verticales ont été relativement légères. En zone pélagique, les apports allochtones de carbone sont probablement négligeables et l'abondance des bactéries hétérotrophes (HNA) est fortement corrélée à la chlorophylle a. Des investigations récentes ont indiqué une production croissante de méthane dans les eaux profondes au cours des trois dernières décennies, menant à une accumulation du gaz et à l'abaissement de l'énergie nécessaire pour déclencher un dégagement massif de gaz, qui serait dévastateur. Le rôle de la production primaire et des changements probables sur le flux d'exportation de matière organique vers les eaux profondes suite à l'introduction de la sardine planctivore du lac Tanganyika *Limnothrissa miodon*, sont discutés. La production primaire actuelle, de  $0.71 \text{ g C m}^{-3} \text{ d}^{-1}$  ( $-260 \text{ g C m}^{-2} \text{ a}^{-1}$ ), ne semble pas spécialement différente des quelques mesures ponctuelles faites dans le passé, ce qui permet d'écarter l'hypothèse d'une eutrophisation d'origine anthropique. Le flux d'exportation de matière organique vers les eaux profondes a très probablement été affecté par des changements biologiques, qui seraient partiellement responsables de l'augmentation de méthane dans les eaux profondes du lac au cours des 30 dernières années.