SOUTH ASIA
BIOSAFETY PROGRAM

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SABP

The South Asia Biosafety Program (SABP) is an international developmental program initiated with support from the United States Agency for International Development (USAID). The program is implemented in India and Bangladesh and aims to work with national governmental agencies to facilitate the implementation of transparent, efficient and responsive regulatory frameworks for products of modern biotechnology that meet national goals as regards the safety of novel foods and feeds and environmental protection.

SABP is working with its in-country partners to:

- Identify and respond to technical training needs for food, feed and environmental safety assessment.
- Develop a sustainable network of trained, authoritative local experts to communicate both the benefits and the concerns associated with new agricultural biotechnologies to farmers and other stakeholder groups.
- Raise the profile of biotechnology and biosafety on the policy agenda within India and Bangladesh and address policy issues within the overall context of economic development, international trade, environmental safety and sustainability.

IS THE REDOX STATE OF VECTOR A DETERMINANT OF PARASITE TRANSMITTING CAPABILITY?

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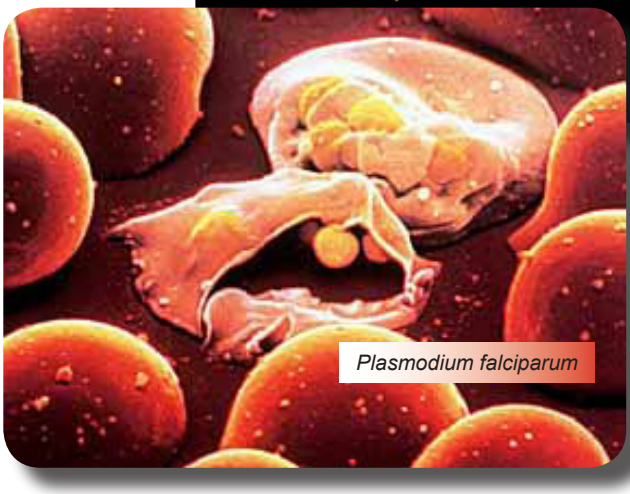
Reactive oxidative species (ROS) are free radicals produced as by-products of oxidation-reduction (REDOX) reactions. At low levels, they are known to act as important signaling molecules. At high levels, they cause damage to cellular processes and contribute to several disorders as well as to the ageing process. To cope up with these fatal cellular consequences, eukaryotic cells have evolved a number of defense and repair mechanisms which are based on both enzymatic and non-enzymatic processes that are highly conserved across species. It has long been recognized that regulation of the redox state is important in defending hosts against pathogens.

The life cycle of human parasite *Plasmodium* within the mosquito vector begins when gametocytes are taken up in an infected blood meal; after forming gametes and fertilization, the resulting zygote differentiates into a motile ookinete that traverses the midgut epithelium and transforms within 36-48 hours into an oocyst between the midgut epithelial cells and the basal lamina. The ookinete invasion of the *Anopheles* midgut is a critical step for malaria transmission; the parasite numbers drop drastically and practically reach a minimum during the parasite's whole life cycle. At this stage, the parasite as well as the vector undergoes immense oxidative stress.

***P**lasmodium* prefers a pro-oxidant environment that contains oxygen and iron with its redox and antioxidant systems well developed to combat stress in both hosts, namely human and mosquito. In spite of this, the parasite numbers dwindle at the time of invasion. Of the several species of *Anopheles*, not all are vectors and there are several strains that are refractory to *Plasmodium* infection. Genetically selected susceptible and refractory strains (4A r/r and L3-5) have been described in the African mosquito, *Anopheles gambiae. Anopheles culicifacies*, the main vector for malaria in India, known to exist as sibling species, also encompasses a natural population that is refractory (R strain) to *Plasmodium* infection. The R strain blocks parasite development in the midgut, oxidatively converting tyrosine to melanin, which crosslinks proteins into a melanotic capsule assembled around the parasite. Morphological analysis of the midgut of the refractory and susceptible strains reveals differences in pericardial cells that are active in detoxification and neutralization of ROS. These morphological differences suggest systemic deficiency in ROS detoxification may contribute to refractoriness in mosquitoes. Previous reports from our lab have shown considerable differences in transcript abundance of immune responsive serine proteases and actively involved in injury response and *Plasmodium* infection.

Anopheles mosquito



Plasmodium falciparum

(continued on page 2 - see Redox)

REDOX - *continued from page 1*

It has now been well established that most cells can adapt to oxidative stress by altering global gene-expression patterns, including transcription and translation of genes encoding antioxidants and other metabolic enzymes. It is becoming increasingly recognized however, that post-translational changes are key regulators of stress responses. Understanding and analyzing the oxidative stress at the time of ookinete invasion will help in evolving strategies to combat *Plasmodium* maturation in the vector and in reducing its transmission.

Our lab uses computational biology and bioinformatic tools to understand oxidative stress in *Anopheles* during *Plasmodium* infection using genomic approaches. Reconstructing the network of differentially expressed genes involved in oxidative stress response in *Anopheles* using *Drosophila* as a model would identify novel genes in *Anopheles* involved in redox state regulation. The work so far has resulted in the identification of 45 differentially expressed genes from a set of 19709 *Anopheles* genes and 143 differentially expressed genes from a set of 14010 *Drosophila* genes. These tentatively identified genes are involved in modulating oxidative stress during parasite invasion and maturation by redirecting carbon flux through different metabolic pathways such as Pentose Phosphate Pathway, glycolysis and carbohydrate metabolism. Further, validation of function of these genes during parasite maturation would lead to the identification of novel transmission blocking molecules in the control of malaria.

FIRST ANNOUNCEMENT: 5TH ECOLOGICAL IMPACT OF GENETICALLY MODIFIED ORGANISMS (EIGMO) MEETING

The 5th EIGMO meeting by the West Palaearctic Regional Section of the International Organisation for Biological Control (IOBC/WPRS) Working Group 'GMOs in Integrated Plant Production' will take place 22-25 June 2011, České Budějovice, Czech Republic. The meeting will be organized by Oxana Habuštová and František Sehnal from the Biology Centre AS CR, Institute of Entomology (http://www.entu.cas.cz/en/). Please reserve these dates!

The IOBC/WPRS working group aims to present a platform for exchange of research results and to stimulate collaborative projects dealing with genetically modified plants and their potential impact on the environment. For details on the objectives of this group see the IOBC/WPRS newsletter Profile Nr. 34 (http://www.iobc-wprs.org/pub/index.html).

Further information on the focus of the meeting, key note lectures and the deadlines for submission of abstracts and title of presentations will be distributed in the second announcement or contact:

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SYMPOSIUM ON BIO-PATENT AND GMO CROPS FOR FOOD SECURITY OF BANGLADESH

On October 23, 2010 a day-long symposium, organized jointly by Dipshikha, an NGO working on agriculture-related activities, and Agriculture Educators Forum (AEF) of Sher-e-Bangla Agricultural University (SAU), was held at SAU, Sher-e-Bangla Nagar, Dhaka. About 100 participants from universities, national research institutes and representatives from private and NGO sectors attended.

The inaugural ceremony was presided over by Professor Dr. Shah-e-Alam, Vice Chancellor, Sher-e-Bangla Agricultural University and Prof. Mohammad Hossain Bhuiyan, President, AEF. It began with an address of welcome by Prof. Dr. Md. Rafiqul Islam, General Secretary, AEF. Other speakers included Mr. Paul C. Tigga, Executive Director, Dipshikha and Dr. Shahidur Rashid Bhuiyan, Professor Department of Genetics & Plant Breeding. With the looming reality of Bangladesh's increasing population and decreasing cultivable land, Vice Chancellor Shah-e-Alam expressed the need to produce more food on limited land and the judicious use of modern biotechnology to substantially contribute toward the food security of Bangladesh. He asked participants to conduct open minded discussions to avoid the debates on the potentially adverse effect of genetically modified food and feeds. He also urged policymakers to base decisions about GM crops/food on scientific merits and on a case-by-case basis.

The inaugural ceremony was followed by two scientific sessions. In the first Prof. Dr. K.M. Nasiruddin, Head, Department of Biotechnology, Bangladesh Agricultural University (BAU), Mymensingh highlighted the global status of genetically engineered plants and discussed the potential for GE crops in Bangladesh agriculture in relation to food security, patenting of GE crops and farmer rights.

Prof. Dr. Emdadul Haque Chowdhury, Department of Pathology, BAU presented a paper on the safety evaluation of genetically engineered foods and explained his own experience working with Bt-corn and not finding a trace of Bt-genes during post-feeding molecular as well as histopathological testing. The session was chaired by Prof. Dr. M. Imdadul Hoque.

The second scientific session included presentations by Dr. Md. Sekander Ali, Associate Professor, BAU and Mr. Syed Ali Biswas, Associate Coordinator, BARCIK. Dr. Ali spoke about the "Attitude of Scientists and University Teachers towards GM crops" while Mr. Biswas spoke on "Patent, GMO and Farmers' Rights".

Dr. Md. Sekander Ali, Associate Professor, BAU presented his paper "Attitude of Scientists and University Teachers towards GM crops" based on surveys carried out through a pre-tested interview among 300 randomly selected respondents most of whom were university teachers and researchers. He found about two-third (63.7%) of respondents had a low-favourable attitude towards GM crops compared to 6% high-favourable, 12.6% neutral and 17.7% low-unfavourable attitude; meaning about 69.7% of the respondents had favourable attitudes towards GM crops.

Mr. Syed Ali Biswas, Associate Coordinator, BARCIK presented a paper "Patent, GMO and Farmers' Rights" where he raised concerns about the patenting of GM crops. He opined that after the green revolution hybrid technology was introduced but had proven inadequate in making the world free from hunger and to overcome the problem GM technology

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The Reading List

. . . new and notable articles

PLANTS WITH GENETICALLY MODIFIED EVENTS COMBINED BY CONVENTIONAL BREEDING: AN ASSESSMENT OF THE NEED FOR ADDITIONAL REGULATORY DATA

Pilacinski. W., Crawford, A., Downey, R., Harvey, B., Huber, S., Hunst, P., Lahman, L.K., Macintosh, S., Pohl, M., Rickard, C., Tagliani. L., and Weber, N.

Crop varieties with multiple GM events combined by conventional breeding have become important in global agriculture. The regulatory requirements in different countries for such products vary considerably, placing an additional burden on regulatory agencies in countries where the submission of additional data is required and delaying the introduction of innovative products to meet agricultural needs. The process of conventional plant breeding has predictably provided safe food and feed products both historically and in the modern era of plant breeding. Thus, previously approved GM events that have been combined by conventional plant breeding and contain GM traits that are not likely to interact in a manner affecting safety should be considered to be as safe as their conventional counterparts. Such combined GM event crop varieties should require little, if any, additional regulatory data to meet regulatory requirements.

Food and Chemical Toxicology (2010) Nov 11. [Epub ahead of print]

TRANSGENIC SUGARCANE PLANTS EXPRESSING HIGH LEVELS OF MODIFIED CRY1AC PROVIDE EFFECTIVE CONTROL AGAINST STEM BORERS IN FIELD TRIALS

Weng, L.X., Deng, H.H., Xu, J.L., Li, Q., Zhang, Y.Q., Jiang, Z.D., Li, Q.W., Chen, J.W. and Zhang, L.H.

To improve transgene expression level, we synthesized a truncated insecticidal gene m-cry1Ac by increasing its GC content from 37.4 to 54.8%, based on the codon usage pattern of sugarcane genes, and transferred it into two sugarcane cultivars (ROC16 and YT79-177) by microprojectile bombardment. The integration sites and expression pattern of the transgene were determined, respectively, by Southern, northern and western blot analyses. The transgenic sugarcane lines produced up to 50 ng Cry1Ac protein per mg soluble proteins, which was about fivefold higher than that produced by the partially modified *s-cry1Ac* (GC% = 47.5%). In greenhouse plant assay, about 62% of the transgenic lines exhibited excellent resistance to heavy infestation by stem borers. In field trials, the *m-cry1Ac* transgenic sugarcane lines expressing high levels of Cry1Ac were immune from insect attack. In contrast, expression of s-cry1Ac in transgenic sugarcane plants resulted in moderately decreased damages in internodes (0.4-1.7%) and stalks (13.3-26.7%) in comparison with the untransformed sugarcane controls, which showed about 4 and 26-40% damaged internodes and stalks, respectively. Significantly, these transgenic sugarcane lines with high levels of insect resistance showed similar agronomic and industrial traits as untransformed control plants. Taken together, the findings from this study indicate a promising potential of engineering an insect-resistant gene to tailor its protein expression levels in transgenic sugarcane to combat insect infestations.

Transgenic Research (2010) Nov 3. [Epub ahead of print]

ENHANCED YIELD PERFORMANCE OF BT RICE UNDER TARGET-INSECT ATTACKS: IMPLICATIONS FOR FIELD INSECT MANAGEMENT

Xia, H., Lu, B.R., Xu, K., Wang, W., Yang, X., Yang, C., Luo, J., Lai, F., Ye, W. and Fu, Q.

The rapid development of transgenic biotechnology has greatly promoted the breeding of genetically engineered (GE) rice in China, and many GE rice lines are in the pipeline for commercialization. To understand field performances of GE rice, key agronomic traits of two insect-resistant Bt rice lines that have been granted biosafety certificates for commercial production in China were evaluated together with their nontransgenic counterparts under environmental conditions with significant differences in insect pressure. Results from the experiments showed enhanced field performances of the Bt GE rice lines compared with the non-GE counterparts for yield-related traits such as number of panicles and filled seeds per plant, under environmental conditions with no insecticide application. No detectable underlying cost of the Bt transgene was observed in the two insect-resistant GE rice lines, particularly in the GE hybrid rice line. Results further indicated significantly greater yield performances of the two insect-resistant GE rice lines under environmental conditions with non-target insect control compared with no insect control. It is concluded from this study that insect-resistant Bt GE rice, particularly the hybrid line, has great potential to maintain its high yield when ambient insect pressure is high. In addition, proper application of insecticides to control non-target insects will guarantee optimal performance of insect-resistant Bt GE rice.

Transgenic Research (2010) Oct 15. [Epub ahead of print]

NUCLEAR AND PLASTID GENETIC ENGINEERING OF PLANTS: COMPARISON OF OPPORTUNITIES AND CHALLENGES

Meyers, B., Zaltsman, A., Lacroix, B., Kozlovsky, S.V. and Krichevsky, A.

Plant genetic engineering is one of the key technologies for crop improvement as well as an emerging approach for producing recombinant proteins in plants. Both plant nuclear and plastid genomes can be genetically modified, yet fundamental functional differences between the eukaryotic genome of the plant cell nucleus and the prokaryotic-like genome of the plastid will have an impact on key characteristics of the resulting transgenic organism. So, which genome, nuclear or plastid, to transform for the desired transgenic phenotype? In this review we compare the advantages and drawbacks of engineering plant nuclear and plastid genomes to generate transgenic plants with the traits of interest, and evaluate the pros and cons of their use for different biotechnology and basic research applications, ranging from generation of commercial crops with valuable new phenotypes to 'bioreactor' plants for large-scale production of recombinant proteins to research model plants expressing various reporter proteins.

Biotechnology Advances (2010) 28(6):747-56.

CALENDAR OF EVENTS

Event	Organized by	Date and Venue	Website
INDIA			
TERI-ITEC Courses 2010-11: Applications of Biotechnology and its Regulation	The Energy and Resources Institute	January 3 – 21, 2011 Gurgaon	http://www.teriin.org/index.php?option=com_events&task=details&sid=302
ICPACC 2011: International Conference on Preparing Agriculture for Climate Change	Punjab Agricultural University	February 6 - 18, 2011 Ludhiana	http://www.pau.edu/int_conf/program.htm
International Conference: Leveraging Agriculture for Improving Nutrition and Health	International Food Policy Research Institute (IFPRI)	February 10 - 12, 2011 New Delhi	http://www.ifpri.org/2020-agriculture-nutrition-health
Indian Seed Congress 2011	National Seed Association of India (NSAI)	February 22 - 23, 2011 Hyderabad	http://www.nsai.co.in/ISC_2011_Delegate.pdf
BIT's 4th Annual World Congress of GENE-2010: Gene Technology, Environment and Economic Growth	BIT Life Sciences, Inc.	December 1 - 4, 2010 Sanshui, Foshan, China	http://www.bitlifesciences.com/wcg2010/fullprogram.asp
International Conference: Food Safety and Food Security	Universitas Gadjah Mada, Hiroshima University, Sichuan Agricultural University, Kasetsart University	December 1 - 4, 2010 Yogyakarta, Indonesia	http://www.faperta.ugm.ac.id/fsfs2010/
6th International Plant Tissue Culture & Biotech Conference	Bangladesh Association for Plant Tissue Culture & Biotechnology (BAPTC&B)	December 3 - 5, 2010	http://www.baptcb.org/ptcb_Confderence_2010.pdf http://www.isaaa.org/kc/events/details.asp?ID=302

BANGLADESH - *continued from page 2*

was being introduced. He expressed his concern with the involvement of multinational companies in GM technology. He suggested upholding farmers' rights in poor countries to avoid their deprivation. A lively discussion followed both sessions.

EFSA UPDATES GUIDANCE ON ENVIRONMENTAL IMPACT OF GM PLANTS

The European Food Safety Authority (EFSA) has published updated guidance for the environmental risk assessment (ERA) of Genetically Modified (GM) plants, reflecting the scientific state-of-the-art in this field.

Scientific experts on EFSA's GMO Panel have updated and further developed its guidance for the environmental assessment of GM applications submitted for authorisation in the EU, in particular with respect to data generation, collection and analysis. The ERA guidance document also addresses the evaluation of possible long-term effects of GM plants and potential effects on non-target organisms (NTOs). This guidance implements the stringent requirements for the environmental risk assessment of GMOs as provided by Directive 2001/18/EC on the deliberate release of GMOs in the environment.

The European Commission requested EFSA in 2008 to further develop and update its guidance on environmental risk assessment, enabling EFSA to build on the work it had initiated in this area in 2007.

In accordance with the conclusions of the Environment Council of December 2008, Member States and stakeholders were closely associated with the review of this guidance. EFSA organised a series of technical discussions on the guidance document with representatives of EU Member States, with non-governmental organisations (NGOs) and with GM applicants to exchange views on the scientific issues. A draft version of the ERA guidance was also launched earlier this year for public consultation which received 494 comments.

In order to assess the safety of a GM plant submitted for authorisation in the European Union, EFSA requires all applicants to follow its guidance documents which specify the type of data and information that should be submitted. In the ERA guidance, EFSA reviewed and updated seven specific areas that need to be addressed when assessing the environmental impact of a GM plant. These include in particular the persistence and invasiveness of the GM plant, taking into account possible plant-to-plant gene transfer; the likelihood and consequences of gene transfer from the plant to micro-organisms; the potential evolution of resistance in target organisms; the potential effects on non-target organisms; the biogeochemical processes, such as changes in soil composition, and the potential impact of the cultivation, management and harvesting techniques of the GM plant.

The guidance document includes detailed requirements for: the choice of appropriate non-GM comparators and types of receiving environments to be considered; long-term effects and the experimental design of laboratory and field studies; and their statistical analysis.

See: http://www.efsa.europa.eu/en/scdocs/scdoc/1879.htm

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