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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.

GUIDELINES FOR THE SAFETY ASSESSMENT OF FOODS DERIVED FROM GE PLANTS: BANGLADESH PERSPECTIVE

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Modern biotechnology has emerged as a powerful tool with many potential applications in agriculture and healthcare. New plant varieties developed using r-DNA techniques, commonly referred to as genetically modified (GM), genetically engineered (GE) or transgenic plants, have been and are being developed with the aim of: enhancing productivity; decreasing dependence on the use of agricultural chemicals; modifying the inherent properties of crops; and improving the nutritional value of foods and livestock feeds. As more GE plants are released and the resultant food products are commercially available and are traded across various countries, concerns have been expressed about their safety for human and animal health and the environment. With this increased awareness, the concept of food safety assurance has assumed importance. As with any method of genetic manipulation there is a possibility of introducing unintended changes, which may in turn have an impact on the nutritional status or health of the consumer.

To address the human health safety of food derived from GE plants, there is a need to adopt a systematic and structured approach to its risk analysis. Risk analysis is a science-based process comprising risk assessment, risk management and risk communication. It is an analytical tool to systematically evaluate safety concerns addressing human health safety of GE foods within a framework for decision making. It also provides a further basis for reviewing the safety evaluation parameters if and when further information becomes available. In order to determine an appropriate mechanism for regulatory control of GE foods, it is necessary to first understand the existing food safety system.

Regulatory control of food safety in Bangladesh is somewhat fragmented with a number of different government institutions, namely, Directorate of Health, Bangladesh Standards and Testing Institution (BSTI), Department of Agricultural Extension (DAE), Directorate General of Food (DG, Food), Ministry of Local Government, Ministry of Commerce, Ministry of Industry, etc., taking responsibility for different foods under different legislation.

The Institute of Public Health performs microbiological and toxicological testing for the licensing of food from outside Bangladesh, but has no legal mandate to regulate food.

The BSTI has the mandate to certify products to Bangladesh standards. There are currently 151 standards covered by BSTI of which 58 are food standards. BSTI has its own council and proposes standards to the Government of Bangladesh. Enforcement of standards includes removal from market of non-standard products. BSTI is also the contact point for the Codex Alimentarius Commission in Bangladesh.

The DAE, under the Destructive Insects and Pest Rules of 1966 (Plant Quarantine), amended up to July 1969, issues phytosanitary certificates for plant materials exported from Bangladesh as well as for imported plants, including fruits and vegetables, processed foods and food additives. DAE performs testing and inspection operations with the focus being plant pests, however, it has a minor role in food safety.

The DG, Food regulates cereal grains and edible oils imported by the Directorate and received as food aid, as well as locally procured food grains. Physical and chemical analyses of food grains and edible oils are performed, as well as field trials of pesticides. Pest control in stored grains is undertaken as is import inspection (post-landing) and bagged commodity sampling.

The Ministry of Local Government performs inspection services at the point of sale in markets and retail outlets under the Pure Food Rules, 1967. The Ministry of Commerce grants import licenses for food, including imports of soy, canola and maize mainly from North and South America.

The Bangladesh Agricultural Research Council (BARC) has no direct mandate for any food safety issue, but as the major agency through which agricultural research and development is implemented in Bangladesh, BARC plays a major role in adopting new agricultural technology. As a supervisory body for the NARS, BARC covers most of the expertise required for review of agricultural products as well as the development of these products.

Considering the role of all of these organizations in the Bangladesh food safety system, it is clear that no single organization or legislative instrument can formulate policy on food safety assessment, including for GE foods.

(continued on page 2 - see ERA)

ERA - *continued from page 1*

In order to address this BARC, in collaboration with BSTI, the Department of Environment, the Institute of Public Health, the DG, Food and other relevant stakeholders, has developed guidelines to establish safety assessment procedures for foods derived from GE plants. The objective of the guidelines is to provide a systemic approach to ensure foods derived from GE plants are as safe as existing foods. These guidelines will provide technical guidance on the safety assessment process for whole foods, food products and foods used as ingredients that are derived from GE plant sources. This document is intended to provide guidance to both applicants and reviewers for regulatory purposes.

The National Committee on Biosafety has already approved the guidelines, which are expected to be gazetted soon by the Ministry of Environment and Forests. The Biosafety Core Committee, in a recent meeting, also proposed a Food Safety Regulatory Committee headed by the Director General, BSTI.

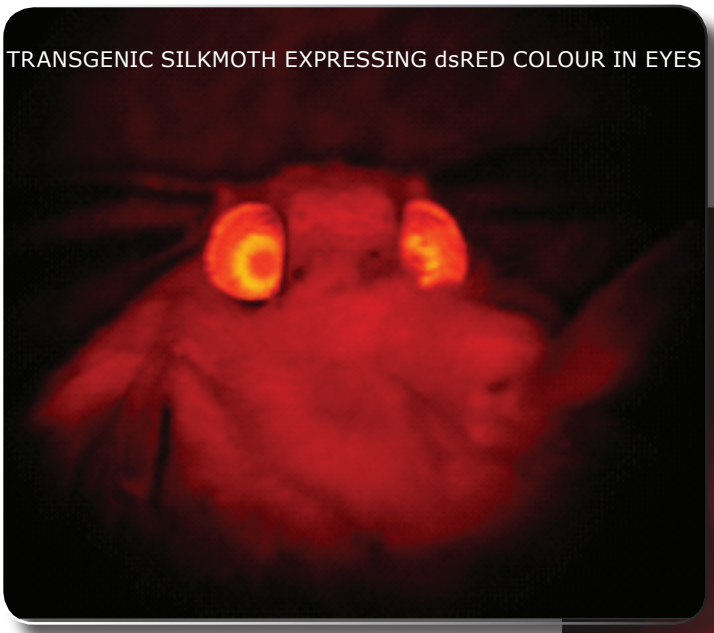
GENETICALLY ENGINEERED SILKWORMS TO ENHANCE SILK PRODUCTION

J. Nagaraju, Ph.D, FNA, FASc, FNASc, Staff Scientist and Group Leader, Laboratory of Molecular Genetics, Centre for DNA Fingerprinting and Diagnostics

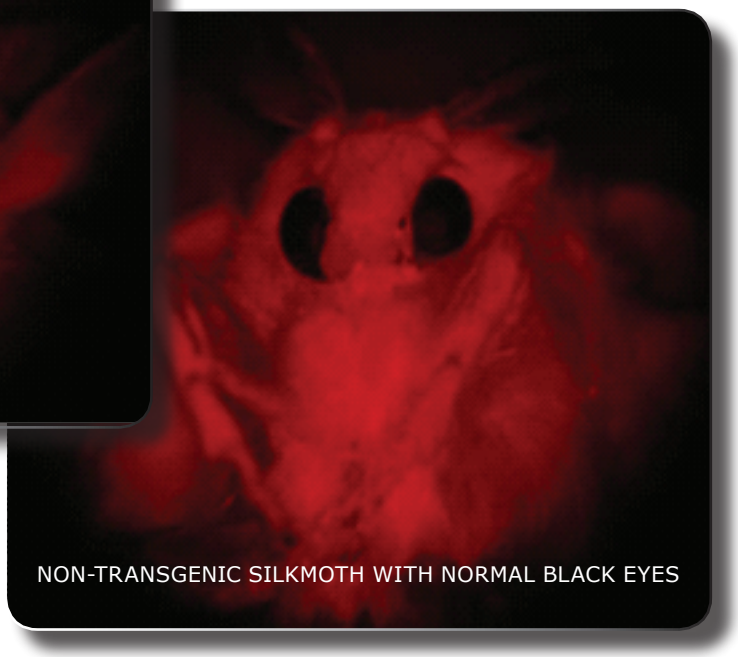
The queen of all natural fibres, silk, secreted by the silkworm *Bombyx mori,* domesticated 5000 years ago in China, is amost sought after commodity by connoisseurs of the world. The occupation of silkworm rearing, silk production and other associated activities (called sericulture) have become an integral part of the cultural life of people in most of the silk producing countries. India, the second largest producer of silk after China, by using 1.80 lakh hectares of land produces about 19000 tonnes which accounts for 15 per cent of global silk production, and provides employment to about six million people most of whom live in rural India. In spite of its sustained growth during the last two decades silk production per unit area of land used and the quality of silk produced are not up to international standards. Among many factors, rearing of low silk yielding tropical breeds that produce inferior quality silk fibre is considered to be a significant one. Attempts to rear temperate silkworm strains from Japan characterized by high silk yield and fine quality silk fibre have not been as successful as had been hoped because they are highly susceptible to *Bombyx mori* Nuclear Polyhedrosis (BmNPV) infection. The major success of Indian sericulture research and development is the introduction of tropical female and temperate male F_1 hybrid silkworm strains and the rearing of exclusive tropical silkworm hybrids in good seasons when conditions are conducive to the culture of temperate silkworm strains. Hence, the problem of low silk productivity and poor silk quality is still looming large in the Indian sericulture industry.

By harnessing recent advancements in the genomic science of silkworm and baculovirus, scientists at the Centre for DNA Fingerprinting and Diagnostics (CDFD) have genetically engineered silkworms that can fight baculovirus infection effectively and thus produce higher silk yields. This technology has also provided a much needed opportunity to rear genetically engineered temperate silkworm strains that are known to produce high yields of quality silk that would otherwise be known to be susceptible to baculovirus infection. The baculovirus resistant engineered temperate silkworm strains will also assure better crop stability for farmers that will improve their economic returns.

The technique involves heritable production of double stranded RNA pieces corresponding to many baculoviral gene-encoded transcripts that are essential for the establishment of infection in the host cells. Through RNA interference-mediated suppression of the essential viral gene transcripts, the engineered silkworms prevent viral proliferation, and thus resist baculovirus infection. The laboratory trials conducted at Andhra Pradesh State Sericulture Research and Development Institute during the last five years demonstrate that the engineered silkworms register ~80 per cent survival when charged with a heavy load of baculovirus. The engineered silkworms are environmentally-friendly as they are always reared indoors and can't survive under outdoor rearing conditions, the adults (moths) are unable to fly and feed, the baculovirus is highly host-specific and the engineered silkworms harbour only pieces of baculoviral DNA that do not code for any proteins. In addition, the large scale silk production is carried out by rearing only F_1 hybrids, the cocoons produced are heat-killed to extract silk fibre, and the engineered silkworms also harbour the marker gene for dsRed colour, which allows transgenic silkmoths to easily be tracked by looking at the red fluorescent eyes, see figure at left, as compared to normal black eyes, below, in non-transgenic moths.



TRANSGENIC SILKMOTH EXPRESSING dsRED COLOUR IN EYES



NON-TRANSGENIC SILKMOTH WITH NORMAL BLACK EYES

The Reading List

. . . new and notable articles

PERSISTENCE OF SUNFLOWER CROP TRAITS AND FITNESS IN *HELIANTHUS PETIOLARIS* POPULATIONS

Gutierrez A, Cantamutto M, Poverene M

Transgenic plants have increased interest in the study of crop gene introgression in wild populations. Genes (or transgenes) conferring adaptive advantages persist in introgressed populations, enhancing competitiveness of wild or weedy plants. This represents an ecological risk that could increase problems of weed control. Introgression of cultivar alleles into wild plant populations via crop-wild hybridisations is primarily governed by their fitness effect. To evaluate this, we studied the second generation of seven wild-crop interspecific hybrids between weedy *Helianthus petiolaris* and cultivated sunflower, *H. annuus* var. *macrocarpus*. The second generation comprised open-pollinated progeny and backcrosses to the wild parent, mimicking crosses that occur in natural situations. We compared a number of morphological, life history and fitness traits. Multivariate analysis showed that the parental species *H. annuus* and *H. petiolaris* differed in a number of morphological traits, while the second hybrid generation between them was intermediate. Sunflower crop introgression lowered fitness of interspecific hybrids, but fitness parameters tended to recover in the following generation. Relative frequency of wild/weedy and introgressed plants was estimated through four generations, based on male and female parent fitness. In spite of several negative selection coefficients observed in the second generation, introgressed plants could be detected in stands of <100 weedy *H. petiolaris* populations. The rapid recovery of fecundity parameters leads to prediction that any trait conferring an ecological advantage will diffuse into the wild or weedy population, even if F_1 hybrids have low fitness.

PLANT BIOLOGY (STUTTG) (2011) 13(5):821-30

SUGGESTED IMPROVEMENTS FOR THE ALLERGENICITY ASSESSMENT OF GENETICALLY MODIFIED PLANTS USED IN FOODS

Goodman RE, Tetteh AO

Genetically modified (GM) plants are increasingly used for food production and industrial applications. As the global population has surpassed 7 billion and per capita consumption rises, food production is challenged by loss of arable land, changing weather patterns, and evolving plant pests and disease. Previous gains in quantity and quality relied on natural or artificial breeding, random mutagenesis, increased pesticide and fertilizer use, and improved farming techniques, all without a formal safety evaluation. However, the direct introduction of novel genes raised questions regarding safety that are being addressed by an evaluation process that considers potential increases in the allergenicity, toxicity, and nutrient availability of foods derived from the GM plants. Opinions vary regarding the adequacy of the assessment, but there is no documented proof of an adverse effect resulting from foods produced from GM plants. This review and opinion discusses current practices and new regulatory demands related to food safety.

CURRENT ALLERGY AND ASTHMA REPORT (2011) AUG;11(4):317-24

PROSPECTS FOR USING PROTEINASE INHIBITORS TO PROTECT TRANSGENIC PLANTS AGAINST ATTACK BY HERBIVOROUS INSECTS

Gatehouse JA

Proteinase inhibitors which act on the digestive enzymes of insect herbivores are a basic mechanism of plant defence. Attempts to exploit this defence mechanism in plant genetic engineering have used overexpression of both endogenous and exogenous inhibitors. While significant protection against insect pests has been routinely achieved, the engineered plants do not show levels of resistance considered commercially viable. As a result of selective pressures, insect herbivores have developed multiple mechanisms of adaptation to overcome the defensive effects of plant proteinase inhibitors. Common polyphagous crop pests are well adapted to deal with a range of different inhibitors, which have only limited effects on fitness as a result. A range of strategies have been attempted to improve effectiveness of proteinase inhibitors as antimetabolites towards insects, including selection for inhibitory activity against insect digestive enzymes, mutagenesis for novel inhibitory activity, and engineering inhibitors with multiple functions. However, proteinase inhibitor genes have only been used in transgenic crops in combination with other insecticidal genes. In Chinese genetically engineered cotton varieties which express Bt toxins as an insecticidal protein against lepidopteran larvae, the CpTI (cowpea trypsin inhibitor) gene has been employed as a second transgene to improve protection. This gene combination represents the only commercial deployment of a proteinase inhibitor transgene to date, with Bt/CpTI cotton grown on over 0.5 million hectares in 2005. Future prospects for using proteinase inhibitor genes to enhance insect resistance in transgenic crops will require reassessment of their mechanisms of action, particularly in affecting processes other than digestion, as exemplified by effects on sap-feeding hemipteran pests.

CURRENT PROTEIN AND PEPTIDE SCIENCE (2011) 12(5):409-16

POLLEN-MEDIATED GENE FLOW IN FLAX (*LINUM USITATISSIMUM* L.): CAN GENETICALLY ENGINEERED AND ORGANIC FLAX COEXIST?

Jhala AJ, Bhatt H, Topinka K and Hall LM

Coexistence allows growers and consumers the choice of producing or purchasing conventional or organic crops with known standards for adventitious presence of genetically engineered (GE) seed. Flax (*Linum usitatissimum* L.) is multipurpose oilseed crop in which product diversity and utility could be enhanced for industrial, nutraceutical and pharmaceutical markets through genetic engineering. If GE flax were released commercially, pollen-mediated gene flow will determine in part whether GE flax could coexist without compromising other markets. As a part of pre-commercialization risk assessment, we quantified pollen-mediated gene flow between two cultivars of flax. Field experiments were conducted at four locations during 2006 and 2007 in western Canada using a concentric donor (20 × 20 m) receptor (120 × 120 m) design. Gene flow was detected through the xenia effect of dominant alleles of high α-linolenic acid (ALA; $18{:}3^{cis\Delta 9,12,15}$) to the low ALA trait. Seeds were harvested from the pollen recipient plots up to a distance of 50 m in eight directions from the pollen donor. High ALA seeds were identified using a thiobarbituric acid test and served as a marker for gene flow. Binomial distribution and power analysis were used to predict the minimum number of seeds statistically required to detect the frequency of gene flow at specific α (confidence interval) and power (1−β) values. As a result of the low frequency of gene flow, approximately 4 million seeds were screened to derive accurate quantification. Frequency of gene flow was highest near the source: averaging 0.0185 at 0.1 m but declined rapidly with distance, 0.0013 and 0.00003 at 3 and 35 m, respectively. Gene flow was reduced to 50% (O_{50}) and 90% (O_{90}) between 0.85 to 2.64 m, and 5.68 to 17.56 m, respectively. No gene flow was detected at any site or year >35 m distance from the pollen source, suggesting that frequency of gene flow was less than or equal to0.00003 (P=0.95). Although it is not possible to eliminate all adventitious presence caused by pollen-mediated gene flow, through harvest blending and the use of buffer zones between GE and conventional flax fields, it could be minimized. Managing other sources of adventitious presence including seed mixing and volunteer populations may be more problematic.

HEREDITY (2011) 106(4):557–566

CALENDAR OF EVENTS

Event	Organized by	Date and Venue	Website
INDIA			
UNEP supported Workshop on Understanding of BCH for Effective Enforcement of Regulation for Transboundary Movement of LMOs/ GMOs	MOEF, National Academy of Customs, Excise and Narcotics (NACEN) and BCIL	September 12, 2011 Faridabad	
National Symposium on Advances in Biotechnological Research in Agri-Horticultural Crops for Sustaining Productivity, Quality Improvement & Food Security	Sardar Vallabhbhai Patel University of Agriculture & Technology	September 14-16, 2011 Meerut, Uttar Pradesh	http://www.svbpmeerut.ac.in or http://www.svbpmeerut.ac.in/repos/SVPUAT%20Symposium.pdf
International Conference on Emerging Trends on Food and Health Security in Cold Deserts	Defence Institute of High Altitude Research, Defence Research and Development Organisation	September 23 - 25, 2011 LEH-Ladakh	
International Conference on Issues for Climate Change, Land Use Diversification and Biotechnological Tools for Livelihood Security 2011	Hi-Tech Horticultural Society and SVPUA&T	October 8 - 10, 2011 Meerut, Uttar Pradesh	http://www.svbpmeerut.ac.in or http://www.svbpmeerut.ac.in/pages/repos/confrence.pdf
National Conference on Recent Advances in Plant Sciences	P.G. Department of Botany, Dharm Samaj College, Aligarh	October 15 - 16, 2011 Aligarh, Uttar Pradesh	https://docs.google.com/document/pub?id=1FJjEInqt_gMcnRtoxZnKc-SyR4AWfwaYJQ7lInfcC4lQ
World Cotton Research Conference	International Cotton Advisory Committee and Indian Society for Crop Improvement under the aegis of Indian Council of Agricultural Research	November 7 - 11, 2011 Mumbai	http://www.wcrc-5.com/WCRC5_Circular.pdf
8th International Safflower Conference: Safflower Research and Development in the World - Status and Strategies	Indian Society of Oilseeds Research and Indian Council of Agricultural Research	January 19 - 23, 2012 Hyderabad	http://www.dor-icar.org.in/down-loads/Conference1.pdf
INTERNATIONAL			
First International Workshop on the Food and Environmental Safety Assessment of Genetically Modified Animals	Argentine Ministry of Agriculture, Livestock and Fisheries, ICGEB; United Nations University Biotechnology Programme for Latin America and the Caribbean and International Life Sciences Institute Argentina	September 5 - 9, 2011 Buenos Aires, Argentina	http://www.agrobiotecnologia.gov.ar/gmanimal2011/
Biosafety Workshop on Problem Formulation: A Strategic Approach to Risk Assessment of GMOs	International Centre for Genetic Engineering and Biotechnology (Trieste)	September 19 - 23, 2011 Trieste, Italy	http://www.icgeb.org/tl_files/Meetings/2011/ICGEB%20TS%20BSF%2019_23%20September%202011.pdf
VII Brazilian Biosafety Congress	National Biosafety Association-ANBio	September 19 - 23, 2011 Joinville/SC, Brazil	http://www.anbio.org.br/
The International Conference of GM Crops	Faculty of Agriculture, Cairo University, Egypt	November 20 - 23, 2011, Cairo University, Egypt	http://www.icgmc2011.com/
Regional Workshop onField Trials and Post-Release Monitoring of GMOs	Ministry of Culture, Zagreb, Croatia	December 5 - 7, 2011 Zagreb, Croatia	http://www.icgeb.org/meet-ings-2011.html
5th International Botanical Conference -- Climate Change and Biodiversity: Role of Plant Scientists	Bangladesh Botanical Society	December 09 – 11, 2011 Department of Botany, University of Dhaka, Bangladesh	www.bdbotsoc.org or http://www.dhakai.com/botany/Circular.pdf

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