

INDIA'S BT BRINJAL BATTLE

On 9 February 2010, Mr. Shri Jairam Ramesh, the then Minister of Environment & Forests, Government of India, declared a moratorium on Bt brinjal stating, *"It is my duty to adopt a cautious, precautionary principle-based approach and impose a moratorium on the release of Bt brinjal till such time independent scientific studies establish, to the satisfaction of both the public and professionals, the safety of the product from the point of view of its long-term impact on human health and environment, including the rich genetic wealth existing in brinjal in our country"*.¹

This paper describes the series of events which took place in India from the development of Bt brinjal to its initial approval by the Genetic Engineering Appraisal Committee (GEAC)^a to the declaration of a moratorium on it by the then Minister of Environment & Forests and events thereafter. It discusses the sustained campaign by civil society including prominent farmers' groups, farmers and consumers supported by many scientists and other professionals to stop the commercialisation of the first ever GE food crop to be introduced in India; a battle *royale* against corporate forces and their allies.

1.0 BACKGROUND

1.1 Bt Crops in India

The regulation of GE crops in India comes under the provisions of the Environment Protection Act 1986 (Rules 1989)^b which was passed to ensure the protection and improvement of the environment. Under the 1989 Rules of the Act, the regulation of genetically modified (or engineered) organisms (GMOs) is managed by six bodies. The two most important are (1) the Review Committee for Genetic Manipulation (RCGM) housed under the Department for Biotechnology (DBT) in the Ministry of Science & Technology which is responsible for greenhouse/contained research approvals and (2) the Genetic Engineering

Appraisal Committee (GEAC), the apex regulator, housed under the Ministry of Environment & Forests (MoEF), which is responsible for environmental release through field trials and commercial approvals of GMOs.²

The first GE crop commercialized in India was Bt cotton. Bt crops are engineered with delta (δ)-endotoxins produced by the soil bacterium *Bacillus thuringiensis* (hence the term Bt). Delta endotoxins are called Cry proteins and there are dozens of them. They are toxic to a range of different classes of insect pests, depending on the type of endotoxin. India has allowed the commercialization of one GE crop thus far; Bt cotton, which has been modified to be toxic to the cotton bollworm.

Bt cotton, developed by Mahyco-Monsanto Biotech Ltd. (MMB), was first commercialised in 2002. Before that, Bt cotton was found to be illegally cultivated in 2001 in Gujarat; the seeds were apparently sold by a company called Navbharat Seeds Pvt Ltd.^{3,4} As of now, 6 different Bt cotton events^c with four different Bt toxin genes (Cry1Ab, Cry1Ac, Cry2Ab and Cry1C)^d have been approved by the GEAC,^{5,6} as well as the 809 hybrids⁷ created with these 6 different event lines.

Bt technology has been licensed by MMB to about 28 seed companies. About 90% of the cotton grown in India is Bt cotton.⁸ The Bt train in India has not stopped with cotton. Numerous food crops engineered with the Bt gene including rice, corn, brinjal, tomato, potato, and okra have been under field trials in various parts of the country.⁹ Many others are in pre-field trial stages of research.¹⁰

Maharashtra Hybrid Seeds Company Ltd. (Mahyco), Bayer BioScience Pvt. Ltd., Metahelix Life Sciences Ltd., DuPont India Ltd., Avesthagen Ltd., JK Agri Genetics Ltd., and BASF India Ltd. are doing research on GE rice of which Mahyco, Metahelix, and Bayer BioScience are currently doing field

^a GEAC was earlier the Genetic Engineering Approval Committee; the name was changed by the Minister to Genetic Engineering Appraisal Committee during the Bt brinjal moratorium decision.

^b Rules for the Manufacture, Use/Import/Export and Storage of Hazardous Micro-organisms/Genetically Engineered Organisms or Cells, 1989, under the Environmental Protection Act of 1986, governs the research, development, large scale use and importation of biotech organisms and their products. Revised guidelines were issued in 1998.

^c The six events are: Mon 531 Event, GFMCry1A Event, JK Event 1, MON 15985 Event, Event MLS 9124, BN Bt Event (retrieved 10 January 2012 from http://igmoris.nic.in/major_developments1.asp).

In order to genetically engineer a plant, so called "gene constructs" are produced and inserted into the plant in a process called transformation. Gene constructs usually contain the trait gene, often combined with extra regulatory elements from different sources, and one or two marker genes which allow the developer to identify and select for the plants or cells that contain the gene construct. In transforming a number of individualised plant cells with a given 'gene construct', each one of the cells will look different from each other. This is because the construct will be inserted into different places of the cell's chromosomes. These transformed cells are then each regrown into a plant, named and numbered, and referred to as an "event". Thus there can be a number of different events, yet each containing the same gene construct, inserted at different locations, potentially disrupting different genes and gene sequences. Thus each event needs to be assessed separately.

^d There are many different Bt endotoxin genes, all coding for different endotoxin proteins. These proteins have a crystalline form and are referred to as Cry proteins (standing for crystal), e.g. Bt Cry1Ac protein.

trials on Bt rice.¹¹ Gene Campaign^e found serious violations in Mahyco's Bt rice trial fields in 2006. These included no isolation measures for the GE trial fields, use of GE trial fields as thoroughfare and not informing the owner farmers that GE rice was being grown on their fields and feeding the GE rice straw to cattle.¹² There have also been various instances of farmer groups protesting against GE rice trials and in some instances uprooting the trial crop.¹³

1.2 Once Bitten, Twice Shy: The Experience of Bt Cotton in India

The introduction and spread of Bt cotton in India has given rise to many problems. By 2006, many reports began exposing various problems experienced by Bt cotton farmers despite the industry's glowing testimonies about the GE crop. Fact-finding teams visited various regions where Bt cotton was being grown and reported the occurrence of new diseases and pests in the fields, high cost of cultivation, uneven crop performance, crop failure and no reduction in pesticide use.^{14,15} They also found incidence of mortality and morbidity in sheep that had grazed in Bt cotton fields.¹⁶ Seed prices were so high that the state government of Andhra Pradesh approached the Monopolies and Restrictive Trade Practices Commission (MRTP) challenging the pricing of Bt cotton seed.¹⁷

Now, ten years after the introduction of Bt cotton, conventional cotton seeds have almost completely disappeared from the market leaving farmers with no choice but to use Bt cotton seeds. Reports of development of resistance in the target pest have come from the field as well as studies.^{18,19} Reports from government cotton scientists have also begun reflecting problems with Bt cotton. According to Dr. Kranthi^f, a leading cotton scientist, secondary pests that were previously not a menace have become a major problem. Sap-sucking insects such as leaf hoppers, aphids, whiteflies, and thrips and insect populations of mealy bugs, mirid bugs, gall midges, mosquito bugs and safflower caterpillars have emerged as serious threats to the Bt cotton crop.²⁰ This has led to increased pesticide use after the initial reported reduction in such use upon the introduction of Bt cotton.^{21,22} Dr. Kranthi also pointed out that Bt cotton productivity has been largely stagnant in the last seven years while the area under Bt cotton has increased from 5.6% of the total cotton area in 2004 to 85% in 2010.²³

Recent civil society reports also pointed out that in addition to these problems, the loss of soil fertility due to repeated cultivation of Bt cotton, the high input requirements of Bt cotton (namely, fertilizers and irrigation), and the

manipulative practices of seed companies have added to the woes of the cotton farmers and farmer suicides continue unabated in the Bt cotton growing areas.^{24,25} Maharashtra, a major cotton growing state, has seen the highest number of farmer suicides in recent years; in 2010, it hit 3,141.²⁶ The crisis is particularly acute in the cotton growing belt of Vidarbha in the state.

1.3 Brinjal and Bt Brinjal in India

Brinjal (a.k.a. eggplant, aubergine, *Solanum melongena* L.) is the second most popular vegetable in India, next to potatoes. Brinjal accounts for about 9% of the total vegetable production and is cultivated on 8.1% of vegetable-growing land. Brinjal grows in almost all parts of the country but eight states^g account for most of the brinjal production in India.²⁷ It is grown as a mixed crop by small farmers and is used mainly for home consumption and domestic sales.

Brinjal is usually self-pollinated, but reported levels of cross-pollination are as high as 48% thereby earning it the classification of a cross-pollinated crop.²⁸ The major pest that afflicts brinjal is the brinjal fruit and shoot borer (BFSB) (*Leucinodes orbonalis*). Some of the other pests are the brinjal stem borer, mealy bug, lace wing bug, and leaf hopper.²⁹ Data on crop yield losses due to BFSB varies. Many estimates claim losses of 60-70%; Prof. David Andow^h reports, based on his analysis of the various studies, that even though losses can be as high as 70%, they typically average around 30%.³⁰

Bt brinjal was first developed by Mahyco using a fusion/hybrid Bt toxin gene (from Monsanto) which produces a hybrid Cry1Ac / Cry1Ab protein. According to the developer, this gene is 99.4% similar to the native Cry1Ac gene from *Bacillus thuringiensis kurstaki*.³¹ The gene is driven by the cauliflower mosaic virus (CaMV) 35S promoter. The other genes in this Bt brinjal event are the antibiotic resistance marker genes *nptII* (codes for resistance to antibiotics kanamycin and neomycin) and *aad* (codes for resistance to antibiotics streptomycin and spectinomycin). The resultant event is named EE-1.³²

The aim of engineering the Bt endotoxin gene (Cry gene) into the brinjal is to make the plant resistant to BFSB, a lepidopteran pest, in this case, a moth. The Bt gene is active in every cell of the Bt brinjal plant, thus producing the Bt toxin throughout the plant. The mode of action of the Bt toxin is described thus: when the BFSB larvae feed on the Bt brinjal, they will ingest the Bt toxin along with plant matter and once the Bt protein reaches the gut of the larvae, it will perforate the gut, disrupt the digestive process and eventually cause paralysis and death of the larvae.³³

^e Gene Campaign is a research and advocacy organisation working to empower local communities to retain control over their genetic resources in order to ensure food and livelihood security (<http://www.genecampaign.org/>).

^f Dr. Keshav Kranthi is the Director of the Central Institute for Cotton Research, the apex government cotton research organization of India. See <http://www.cicr.org.in/>

^g The major brinjal growing states in India are West Bengal, Orissa, Bihar, Gujarat, Maharashtra, Karnataka, Uttar Pradesh & Andhra Pradesh.

^h Prof. Andow, an internationally recognized entomologist with the University of Minnesota, had sent comments on Bt brinjal to the Minister of Environment & Forests and given his full report in September 2010 on Bt brinjal which was submitted to the Supreme Court as part of the public interest litigation on GM crops in India.

1.4 Who Owns Bt Brinjal?

Mahyco, the largest seed company in India, in which Monsanto Co. has a 26% stake,ⁱ developed the first Bt brinjal. The Cry gene for it was obtained from Monsanto Co. USA. In 2005, Mahyco further sub-licensed the event EE-1 to Tamil Nadu Agricultural University (TNAU), University of Agricultural Sciences (UAS), Dharwad and Indian Institute of Vegetable Research (IIVR)^j, Varanasi, in a public-private partnership (PPP) mode, under the Agricultural Biotechnology Support Project-II (ABSP-II)^k.³⁴ ABSP-II played a pivotal role in funding the consortium partners for the research and development of Bt brinjal.³⁵ The ABSP-II is also involved in developing and commercialising Bt brinjal in the Philippines and Bangladesh.^l

In addition to the event EE-1, two other Bt brinjal events have been developed in India; one by the Indian Agricultural Research Institute (IARI) using the Cry1Ab gene and the other by Bejo Sheetal Seeds Co. using the Cry1Fa1 gene.

1.5 Health Concerns Over Bt Crops

In discussing the issue of Bt brinjal, mention must be made about why there is such concern over it as well as other GE crops. Herbicide-tolerant and insect-resistant GE crops are responsible for 99% of the global acreage in GE crops, with the former covering 83.3% of the global acreage.³⁶ About 35% of the global acreage in GE crops contain the Bt trait.

Bt crops in the market include maize, potato, cotton, and poplars; many are in the testing phase, including Bt rice, Bt brinjal, and Bt soy. The major health concern of Bt crops are related to allergenicity and immunological impacts on the gut, especially with Cry1Ab and Cry1Ac, which are found in Bt maize, Bt cotton, Bt brinjal and Bt rice.

Mice-feeding studies on Monsanto's Bt corn (MON 810) found adverse impacts on the gut and peripheral immune systems of young as well as old mice.³⁷ A meta-analysis of feeding studies longer than 90 days involving GE corn and GE soya found that the kidneys were particularly affected in the males while the liver was specifically disrupted in the females. The researchers concluded that 90 days were "...insufficient to evaluate chronic toxicity....no minimal length

for the tests is yet obligatory for any of the GMOs cultivated on a large scale, and this is socially unacceptable in terms of consumer health protection."³⁸

A number of studies have found similarities between certain Cry proteins and known human allergens such as betalactoglobulin (a major milk allergen) and vitellogenin (an egg yolk allergen) proteins.³⁹ A doctor's study in Madhya Pradesh on the health of Bt cotton farmers and workers in cotton ginning factories found strong suggestive evidence of allergic responses to Bt cotton.⁴⁰ The respondents displayed a variety of symptoms ranging from itching of the skin and itching, redness, and/or swelling of the eyes to runny noses and excessive sneezing. The symptoms of the cotton pickers increased in severity as long as they continued to work in the fields and decreased when they stopped work. These problems began at the time Bt cotton was introduced.

In 2011, a report on a study conducted with 30 pregnant and 39 non-pregnant women in Canada whose blood samples were tested for the pesticides glyphosate and glufosinate as well as for Cry1Ab (all associated with GE crops) was released. Cry1Ab was detected in 93% and 80% of maternal and foetal blood samples, respectively, and in 69% of the tested blood samples taken from the non-pregnant women.⁴¹ The scientists concluded, "To our knowledge, this is the first study to highlight the presence of pesticides-associated genetically modified foods in maternal, fetal and non-pregnant women's blood. 3-MPPA (the metabolite for glufosinate) and Cry1Ab toxin are clearly detectable and appear to cross the placenta to the fetus."

2.0 THE BT BRINJAL SAGA UNFOLDS

2.1 Mahyco Develops Bt Brinjal

Mahyco did greenhouse breeding experiments on Bt brinjal with EE-1 from 2000 to 2002 and the first level of confined field trials took place from 2002-2004. The approval for the next level of open air multi-location research trials (MLRTs) was granted to Mahyco in 2004 by the Review Committee for Genetic Manipulation (RCGM)^m. TNAU and UAS crossed the event EE-1 into local varieties of brinjal – TNAU into four varietiesⁿ and UAS into six^o, at the Mahyco research centre

ⁱ Monsanto Co.USA through its fully owned subsidiary Monsanto Holdings Private Ltd. has a 26% stake in Mahyco Ltd. and the two companies also have a 50:50 joint venture partnership called Mahyco-Monsanto Biotech (India) Ltd., which markets Bt cotton technology in India to other seed companies.

^j TNAU and UAS are reputed public sector agriculture universities, located in the southern Indian states of Tamil Nadu and Karnataka, respectively. The IIVR is the leading national vegetable research institution (<http://www.iivr.org.in/>) managed by the Indian Council for Agriculture Research (ICAR), an autonomous organization under the Ministry of Agriculture.

^k ABSP-II is a United States Agency for International Development (USAID) funded consortium led by Cornell University that lists among its many partners, Monsanto, Mahyco, Numhens (subsidiary of Bayer), Sathguru Management Consultants, the International Service for the Acquisition of Agribiotech Applications (ISAAA), and the Indian Council for Agricultural Research (ICAR).

^l Their partner organizations are the Institute of Plant Breeding, College of Agriculture, University of Philippines (UPLB) and the Bangladesh Agriculture Research Institute (BARI) and East West Seeds, Bangladesh (changed its name to Lal Teer Seed Ltd. in 2007).

^m The field trial approval process then had three stages: strip trials, multi-level research trials (MLRTs) during which biosafety studies were done, and large-scale field trials (LSTs). Since 2008, the MLRTs and LSTs have been replaced by Biosafety Research Level 1 (BRL 1), and BRL II trials in a new approval system.

ⁿ Co2-Bt, MDU1-Bt, KKM1-Bt, PLR1-Bt are the four Bt brinjal varieties (engineered with EE-1) developed by TNAU, Coimbatore.

^o Malapur local (S) Bt; Manjarigota Bt (MG Bt); Udupigulla Bt (UG Bt); Kudachi local Bt (KLt); R. Pabkavi local Bt (RL Bt) and GO112 Bt expressing Event EE1 are the six Bt varieties developed by UAS Dharwad.

with help from Mahyco scientists. In 2006, Mahyco obtained permission from the GEAC to export^P Bt brinjal seeds with event EE-1 to Bangladesh and Philippines.⁴²

2.2 Multi-location Research Trials (MLRTs)

In 2004-2005, the MLRTs of Bt brinjal hybrids of Mahyco were conducted in numerous locations across India. It was reported that at least in one location in Kurnool District, Andhra Pradesh, biosafety violations took place such as not informing neighbouring farmers about the trials and allowing the family of the farmer in question to consume and sell the Bt brinjal.⁴³ By May 2006, Mahyco had submitted the biosafety data generated from the MLRTs and sought permission for large-scale field trials (LSTs).⁴⁴ GEAC discussed Mahyco's application for LSTs and seed production of seven Bt brinjal hybrids^Q containing the event EE-1.

Representations were sent from the Centre for Sustainable Agriculture (CSA)^R, Greenpeace, several other civil society groups and individuals demanding that the biosafety data on Bt brinjal be posted on the MoEF website for feedback prior to approving LSTs. Bowing to public pressure, GEAC complied.⁴⁵ However, it came to light that GEAC had released only the summary data. In June 2006, civil society questioned the GEAC on the need for Bt brinjal and raised issues concerning the Bt toxin, the inadequacy of the summary data and testing, and the lack of transparency in corporate research.⁴⁶

2.3 Opposition to Bt Brinjal Emerges

The numerous problems associated with Bt cotton that were emerging from the cotton-growing regions from 2004 onwards had incensed many farmers' and civil society groups. They submitted fact-finding reports to the government about the problems and sought a ban on Bt cotton but to no avail. This set the stage for the people's resistance to Bt brinjal, which was then undergoing field trials – the people did not want a repeat of the Bt cotton fiasco. From there, the objection to Bt brinjal, which if approved would be the first ever GE food crop to be introduced in the country, began building up across the country. Prominent farmer, consumer and civil society groups working on agriculture, food, environment and public health issues; and numerous concerned individuals and professionals from different segments of society became increasingly concerned over the issue of Bt brinjal. Some of these groups began working together as loosely organized coalitions on the issue of Bt brinjal in particular and GE crops in general. Over time, as the Bt brinjal matter intensified, many more groups and individuals from around the country joined the campaign.

2.4 GEAC Forms EC1

In response to the submissions, objections and various concerns raised about Bt brinjal by civil society, GEAC decided, in August 2006, to constitute an expert committee (Expert Committee 1 or EC1) chaired by Dr. Deepak Pental to examine these issues and suggest additional studies to



Silent demonstration against and 'cremation' of Bt brinjal in Bangalore in January 2009 calling for the state government of Karnataka to ban Bt brinjal. (Photo courtesy of G.Krishna Prasad, Sahaja Samrudha)

^P According to Mahyco, the brinjal varieties were originally imported from Bangladesh and the Philippines, into which the event EE-1 was back-crossed and then exported back to them.

^Q MHB-4 Bt, MHB 9 Bt, MHB 10 Bt, MHH 80 Bt, MHB-99 Bt, MHB-11 Bt and MHB-39 Bt are the seven Bt brinjal hybrids containing the EE-1 event.

^R The Centre for Sustainable Agriculture (CSA) is a professional resource organization engaged in establishing models of sustainable agriculture, working in partnership with NGOs and Community-based organizations by scaling up the successes and engaging with policy-makers for policy change. (<http://www.csa-india.org/>).



A member of the GM-free Karnataka Coalition carrying a box containing petitions at a rally against Bt brinjal in January 2009. This rally was part of the “I Am No Lab Rat” campaign launched against Bt brinjal.

(Photo courtesy of G.Krishna Prasad, Sahaja Samrudha)

evaluate the safety of Bt brinjal and a protocol for a socio-economic evaluation.⁴⁷ Civil society objected to Dr. Pental's appointment as Chair as he was a GE crop developer whose product (GE mustard) was in the pipeline and also to Dr. Mathura Rai (Director of IIVR, which is a part of Agricultural Biotechnology Support Project-II) being part of the expert committee.^{48,49} Dr. Pental subsequently withdrew as Chair of EC1.⁵⁰

2.5 Public Interest Litigation

In 2006, Ms. Aruna Rodrigues and others^S, who had in 2005 filed a Public Interest Litigation (PIL)[†] suit in the Supreme Court of India for a 10-year moratorium on GE crops, made an interim application to the court. They requested that all field trials of GE crops be stopped immediately due to the threat of contamination of non-GE crops by GE pollen and seed. In response, the Supreme Court, in an interim order dated 22 September 2006, directed GEAC not to grant fresh approvals for any GE crop field trials till further orders from the court.⁵¹ This order resulted in the Bt brinjal LSTs decision being stalled for the next two planting seasons. The Supreme Court also recommended that two independent experts be nominated to the GEAC.

In February 2007, the Supreme Court requested the Ministry of Environment & Forests to appoint Dr. Pushpa Mittra Bhargava^U and Dr. M. S. Swaminathan^V as special invitees to GEAC.⁵² In this capacity, Dr. Bhargava consistently and unequivocally sought more stringent protocols, independent testing, long-term studies on the chronic effects of GE food, and a moratorium on trials of GE food crops until concerns were resolved. In addition, he suggested that in view of the seriousness of the issue of food and agrarian livelihood security in India, it was essential to consider alternatives before deciding on the need for any GE crops. He also objected to the approval of Bt brinjal LSTs.^{53,54}

GEAC and the Government of India appealed against the Supreme Court's interim injunction. Consequently, it was partially modified by the Court on 8 May 2007, i.e. pertaining to approvals (for field trials) given between May and September 2006 (Bt brinjal LSTs were not one of them). The court directed that field trials should be carried out under stringent oversight and with all necessary precautions to ensure no contamination takes place.⁵⁵ One year later, in February 2008, it declared that GE field trials could continue.

^S The PIL (Writ Petition (Civil) No. 260 of 2005, Aruna Rodrigues & Ors. versus Union of India & Ors. Supreme Court of India) was filed by Aruna Rodrigues and three other petitioners; Devinder Sharma, Rajeev Baruah & PV Sathesh, seeking a 10-year moratorium on GE crops in India. The Court combined this with an earlier petition in the Supreme Court filed by Gene Campaign (Writ Petition (Civil) No. 115 of 2004. Gene Campaign & Another versus Union of India & Ors. Supreme Court of India).

[†] Under Indian law, a Public Interest Litigation (PIL) is a case which is allowed to be introduced in court for the protection of public interests. The person who files the case need not be the aggrieved party and can be any member of the public (individual or institution).

^U Dr. Bhargava is a molecular biologist and the Founder & Former Director of the Centre for Cellular and Molecular Biology. He is known as the “Father of Modern Biotechnology in India”.

^V Dr. M. S. Swaminathan is an agriculture research scientist, known as the “Father of the Green Revolution in India” and is the founder of the MS Swaminathan Research Foundation.

2.6 Independent Expert Committee Formed by Civil Society

In the meantime, an independent expert committee^W, which had been constituted by civil society to look into Bt brinjal biosafety issues, submitted its report in October 2006. It pointed out that the data made available by GEAC was only a summary of the tests done on Bt brinjal and raised concerns about the lack of independent scrutiny of samples, breach of protocols, problems with animal feeding studies, and the lack of comparison between the efficacy of Bt brinjal with good agronomic practices already proven, among other issues.⁵⁶

2.7 Conditional Approval for Large-scale Field Trials

In July 2007, EC1 concluded that the biosafety data of Bt brinjal was “in accordance with the protocol and procedures stipulated”⁵⁷ by GEAC. But as Bt brinjal was the first GE food crop to be released in India, and was also to be released worldwide, it recommended that additional tests be conducted to explicitly establish the benefits of Bt brinjal in comparison with existing pest management technologies. However, it approved LSTs of Bt brinjal subject to the following conditions: (a) the trials were to be conducted under the direct supervision of the Indian Institute for Vegetable Research (IIVR), (b) the trials were to comply with the Supreme Court’s directives of May 2007 (see Section 2.5) and (c) additional biosafety studies and a socio-economic study were to be conducted along with the LSTs.⁵⁸ GEAC approved the field trials in August 2007.⁵⁹ LSTs were conducted during the second half of 2007 and in 2008 under the supervision of the IIVR. Meanwhile in 2007-2008, TNAU and UAS conducted MLRTs of their Bt brinjal varieties, which were the traditional brinjal varieties crossed with the genetically engineered Bt event EE-1 obtained from Mahyco under ABSP-II. However, no LSTs were done for these varieties.

2.8 Battle for Biosafety Data

The unavailability of the complete, raw biosafety data of Bt brinjal in the public domain became a point of contention between civil society and GEAC. Various groups repeatedly asked the Department of Biotechnology (DBT) and GEAC to make Bt brinjal biosafety data accessible, but in vain. The petitioner in the PIL at the Supreme Court had also sought

for complete biosafety data of all GE crops to be made available in the public domain.

A Greenpeace campaigner initiated an application under the Right to Information (RTI) Act^X in February 2006, seeking information from the DBT on the location of field trials and biosafety data (toxicity, allergenicity and other data) in respect of Bt brinjal and other GE crops under trial. Gene Campaign also submitted RTI applications for the release of biosafety data on Bt brinjal.

The Greenpeace request was refused by the DBT citing commercial confidentiality and business reasons. However, Greenpeace relentlessly pursued the matter and finally received a favourable judgement in 2007 from the Central Information Commissioner (CIC)^Y directing that all biosafety data pertaining to Bt brinjal be made accessible to the public. The DBT did not pay heed and Greenpeace went back to the CIC and received a second favourable order in November 2007.⁶⁰

In response, Mahyco filed a case in the Delhi High Court in December 2007, contesting the CIC order to make the Bt brinjal data public and hearings on this case were held up to August 2008. By this time, the Supreme Court had already—through its order on 15 February 2007 (in connection with the PIL against GE crops)—directed that biosafety data of all GE crops under field trials be made accessible to the public. DBT and GEAC did not comply with the order until August 2008.

On 25 August 2008, after intense pressure (including filing a contempt of court petition) by the lead petitioner of the PIL, Ms. Rodrigues, in the Supreme Court, GEAC released the Bt brinjal biosafety data on the MoEF website.⁶¹ Thereafter, Ms. Rodrigues and Greenpeace approached Prof. Gilles-Eric S eralini of the Committee for Research & Independent Information on Genetic Engineering (CRIIGEN)^Z for an independent evaluation of the Bt brinjal biosafety dossier. Other independent scientists of international repute were also approached by Ms. Rodrigues for their evaluation and feedback.

2.9 Growing Public Outreach and Awareness-building

Intense efforts were taken by civil society to create public awareness about Bt brinjal and GE crops in general. As part of these efforts, documentary films on GE crops^{aa}

^W The independent expert committee was chaired by Dr. K. P. Prabhakaran Nair and consisted of scientists from different disciplines including sociology.

^X The Right to Information Act, 2005 (RTI) was enacted by the Indian Parliament to enable citizens to seek information from any public authority. The said authority is required to respond within 30 days. The law came into force in October 2005.

^Y The CIC is the highest level body from which a decision pertaining to an RTI query can be obtained.

^Z Professor Gilles-Eric S eralini is the President of the Scientific Board, CRIIGEN & Professor of Molecular Biology. CRIIGEN describes itself as an independent non-profit organization of scientific “counter-expertise” to study GMOs, pesticides and the impacts of pollutants on health and the environment, and develop non-polluting alternatives. http://www.criigen.org/SiteEn/index.php?option=com_content&task=view&id=12&Itemid=103.

^{aa} Some of the documentary films which were made: (a) ‘So Shall You Reap’, directed by Ajay Bharadwaj, is about the impact of Bt cotton cultivation on farmers, their testimonies and the alternatives available (<http://www.gmwatch.eu/gm-videosb/27-gm-in-india/11744-so-shall-you-reap>); (b) ‘Bhallu and Uday’ by Greenpeace on GE food crops (<http://www.youtube.com/watch?v=61cBAAcfwXI> & <http://www.youtube.com/watch?v=MDsdMYeZx2Y>); and (c) ‘Kathireekaa’ by the Safe Food Alliance specifically about Bt brinjal.

were produced and screened by different groups and filmmakers. A highly popular one was *"Poison on the Platter"*^{bb} which was screened in many places to prominent citizens and people from all walks of life who took part in discussions on the film after the screenings.

An urban awareness campaign called "I am no lab rat" was launched in mid-2008. In addition to creating awareness, it succeeded in collecting more than 70,000 petitions addressed to Dr. Anbumani Ramadoss, the then Minister of Health & Family Welfare and the Prime Minister, asking them to stop the commercialisation of Bt brinjal. Meanwhile, a rural awareness campaign resulted in 17,000 handwritten postcards being sent from farmers addressed to Dr. Ramadoss. In December 2008, Dr. Ramadoss publicly expressed his opposition to GE crops in general and Bt brinjal in particular.^{62,63} Brinjal seed and food festivals were held around the country by various groups from 2008-2009, drawing thousands of people. They drew people's attention to the wide diversity of brinjals available within the country, the various local delicacies prepared with it, its use in Indian systems of medicine, and the traditions and rituals attached to it as well as to the critical issues associated with GE crops/food. Many prominent scientists and activists wrote opinion pieces in newspapers and spoke at seminars about their concerns over the problems surrounding Bt brinjal.

The campaigns also brought out many issues. Concerns surrounded the adverse effects of Bt toxins reported in various studies from around the world and the resulting threat of these toxins in a vegetable which was consumed directly, raw as well as cooked. Another was the negation of consumer choice due to the absence of labeling laws and the fact that even if such laws were put in place, it would not be possible to implement them in the Indian context, where much produce is sold through small informal markets. Yet another issue was about the impact of Bt toxins on traditional Indian systems of medicine which use brinjal extensively.

On its part, the biotechnology industry used its tremendous influence and financial power to promote Bt brinjal (even though it was not yet approved by the regulators) through conferences, seminars, lobbying, media articles and other promotional measures.

2.10 Independent Scientists Give Their Verdict on Bt Brinjal

As efforts by civil society to create public awareness intensified, reports from independent scientists began coming in, citing problems with the biosafety dossier on Bt brinjal. All of them agreed that the data presented and assessment performed were highly inadequate. Prof. Séralini of CRIIGEN, for example, submitted a scathing report on Bt brinjal and concluded, "Based on these tests,

Bt brinjal cannot be considered as safe. The agreement for Bt brinjal release may present a serious risk to human and animal health and the release should be forbidden."⁶⁴ He pointed out many problems such as: the testing had been done with a surrogate protein and not with the protein generated within Bt brinjal; the problematic presence of a marker gene that conveyed resistance to the antibiotic kanamycin; the technology was outdated and should not contain any antibiotic resistance genes; rats fed with Bt brinjal had suffered diarrhoea, decrease in liver weight and other problems while in cows, there was difference in milk production and composition; and the longest feeding trials had been only for 90 days. He stressed that it was essential to do long-term, multigenerational feeding studies for chronic toxicity.

Dr. Judy Carmen^{cc} highlighted that the studies undertaken were insufficient to assess the safety of Bt brinjal; the methodology and results of the studies were insufficiently reported with almost no statistical analysis; and the sample sizes were too small (e.g. only 3 fruits and 4 animals had been used as samples).⁶⁵

Dr. Doug Gurian-Sherman^{dd} reported that almost no evaluation had been done on the risk of gene flow to wild relatives especially when there was evidence that many wild relatives of brinjal existed in India. He also questioned the data on outcrossing over 30 meters, stating that pollination by bees occurs over several kilometers, and that isolation distance alone, unless extreme, is not an adequate deterrent to gene flow over time. He further recommended that the impact of the introduction of Bt genes into wild and weedy brinjal relatives through Bt brinjal be examined to fully understand the risks.⁶⁶

2.11 GEAC Decides in Favour of Bt Brinjal

When the results of the LSTs of Bt brinjal were placed before GEAC in January 2009, it decided to form another Expert Committee (EC-II) to evaluate the data and examine the concerns and objections raised by civil society, the findings received from independent scientists and the reports received by the Ministry of Health & Family Welfare about the potential adverse impacts of Bt brinjal.⁶⁷ EC-II was set up in May 2009 with GEAC Co-Chair Prof. Arjula R. Reddy as its Chairperson.⁶⁸

EC-II met twice and submitted their report stating that the assessment of the Bt brinjal event EE-1 was in line with biosafety guidelines and those laid down by GEAC and that all concerns raised by the independent scientists had been adequately addressed in the Bt brinjal biosafety dossier. The EC-II also dropped many of the previous EC's and Dr. Bhargava's recommendations for various studies and tests (ironically more than 25% of EC-II members had been part of EC I).⁶⁹

^{bb} A film 'Poison on the Platter', directed by Ajay Kanchan, narrated by Mahesh Bhatt, a prominent film director, is about GE food in general and Bt brinjal in particular, and it was made in the context of the Bt brinjal campaign (<http://topdocumentaryfilms.com/poison-on-the-platter/>).

^{cc} Dr. Judy Carmen is the Director of the Institute of Health and Environmental Research Inc. (IHER), a not-for-profit research institute with an interest in genetically modified (GM) organisms, particularly GM food.

^{dd} Dr. Sherman is a Senior Scientist in the Food & Environment Program at the Union of Concerned Scientists (UCS) in the United States. He focuses on agricultural biotechnology and sustainable agriculture and is widely cited on biotechnology and GE food issues.



Some participants protesting against Bt brinjal at the Bangalore Public Consultation on Bt brinjal on 6 February 2010. (Photo courtesy of Centre for Environment Education)



The Hyderabad Public Consultation on Bt brinjal on 31 January 2010. Huge crowds turned up for all such public consultations in the country. (Photo courtesy of Centre for Environment Education)

EC-II declared that Bt brinjal (with the event EE-1) was safe for environmental release, including varieties developed by TNAU and UAS which had not even undergone LSTs. On 14 October 2009, based on the EC-II report, GEAC recommended the commercial release of Bt brinjal and forwarded it to the Minister of Environment & Forests for a final decision.⁷⁰

2.12 Opposition from the Public Grows

Bt brinjal had become a newsworthy issue; on one hand, there was intense and broad-based opposition to it from

the various segments of society and on the other hand, the biotechnology industry and many local scientists were promoting it assiduously. Therefore, the media was out in large numbers to hear GEAC's decision. Individuals and groups responded to GEAC's recommendation for the commercial release of Bt brinjal by sending letters and protest faxes to the then Minister of Environment & Forests, Mr. Shri Jairam Ramesh.

The Minister subsequently conveyed his decision to put the EC-II report up on the Ministry's website for feedback and to hold a series of public consultations to arrive at a decision in

“the public and national interest”.⁷¹

Civil society groups pointed out the conflict of interest in the composition of EC-II namely that two scientists in the committee were Bt brinjal developers and one of them was also part of an ABSP-II partner organization, another member was from an organisation which had carried out Mahyco-sponsored studies on Bt brinjal and yet another was under investigation for favouring Mahyco in a separate instance.^{ee,72,73}

Civil society groups stepped up protests and actions and exhorted people to attend the public consultations in large numbers and express their views. Thousands of Indians participated in the one-day fast organised on Martyr's Day^{ff} to “Stop Bt Brinjal: Protect Our Food Sovereignty”. More than 100,000 people across the country fasted including state ministers, artists, writers, and farmers.

2.13 State Governments Take a Stand

Many state governments had (and continue to have) serious concerns about GE crops. They were worried about the

impact of Bt brinjal on human health and the environment. They were also concerned about corporate control over agriculture through GE seeds. The day after GEAC declared its decision, the Minister of Agriculture of Orissa⁹⁹ announced that the state would not allow Bt brinjal (or any other GE crop) as the commercialization of such crops was not in the interests of small farmers and the protection of local biodiversity.⁷⁴ A week later, Chhattisgarh's Minister of Agriculture conveyed his opposition to Bt brinjal citing health and biosafety concerns. Kerala^{hh} had set the ball rolling by announcing its policy to keep the state GE free in 2007⁷⁵ and reiterated its stand while the Bt brinjal decision was pending. Its Agriculture Ministry and State Biodiversity Board also played an active role in writing to other states and governments to oppose Bt brinjal and GE crops.

After receiving GEAC's recommendation regarding Bt brinjal, the then Minister of Environment & Forests wrote to the six major brinjal growing statesⁱⁱ. Eleven states responded with their objections and concerns over Bt brinjal⁷⁶ while two more states declared their opposition shortly afterwards.^{jj}



Shri Jairam Ramesh, the then Minister of Environment & Forests, interacting with participants at the Nagpur public consultation on Bt brinjal held on 27 January 2010.

(Photo courtesy of Centre for Environment Education)

^{ee} A complaint was at that time pending against Dr. K K Tripathi with the Central Vigilance Commission (CVC) (CVC Complaint No. 780/09/6 dated 6/6/09 for “abuse of power”). This complaint, filed by Nuziveedu Seeds Ltd, stated that Dr. Tripathi had exercised undue discretionary power to promote the interests of certain companies (Mahyco specifically).

^{ff} 30 January is the death anniversary of Mahatma Gandhi, the father of the nation, and is observed as Martyr's Day in India. Fasting as a tool for moral protests has tremendous emotional appeal in Indian culture due to the numerous fasts Gandhi undertook during the struggle for independence from the British.

⁹⁹ A state in eastern India, which produces 20% of India's brinjal output and has a large number of native varieties.

^{hh} Kerala state is located in the southern tip of the Indian peninsula and is in the ecologically fragile Western Ghats.

ⁱⁱ West Bengal (30%), Orissa (20%), Bihar (11%), Maharashtra (6%), Andhra Pradesh (6%) & Karnataka (4%).

^{jj} The 11 states (Kerala, Chhattisgarh, Karnataka, Bihar, West Bengal, Orissa, Andhra Pradesh, Uttarakhand, Tamil Nadu, Madhya Pradesh, Himachal Pradesh) which wrote to the Minister are listed in his decision note. Gujarat the 12th state to object, did it on the day of the moratorium (<http://www.business-standard.com/india/news/gujarat-appeals-centre-not-to-permit-bt-brinjal/85335/on>). A 13th state, Delhi, joined the list when the Chief Minister assured civil society that Delhi would not allow Bt brinjal.



From left to right: Dr. U .R. Ananthamurthy an eminent author (winner of the Jnanapith Award, the highest literary honour in India); Shri Jairam Ramesh, the then Minister of Environment & Forests; and Mr. H. D. Deve Gowda, former Prime Minister of India, at the Bangalore Public Consultation on Bt brinjal (6 February 2010)

(Photo courtesy of Gandal Srikanta)

2.14 The Minister Declares Moratorium on Bt Brinjal

A series of public consultations held in January and February 2010 in seven cities^{kk} across India, attended by over 8000 people^{ll}, was characterized by large crowds of protestors and participants. After listening to the participants and reviewing all the feedback and responses received, Mr. Shri Jairam Ramesh, the then Minister of Environment & Forests, on 9 February 2010, announced his decision to declare a moratorium on Bt brinjal, which he termed as “responsible to science and responsive to society”.⁷⁷

The Minister announced the moratorium decision via a press conference (telecast live) and also made public his ‘decision note’, which laid out the basis for his decision, supported with an annexure containing the responses he had received. Both were uploaded on the MoEF website.⁷⁸

The Minister said that even scientists were not able to agree on the safety of Bt brinjal, and eleven state governments, including all the major brinjal-growing states, had conveyed their objection to it. He shared that he had received feedback from numerous scientists around the

world and India, in addition to feedback from civil society, doctors, environmentalists and the public at large. Among the many scientists who had written to him were: (a) Dr. M. S. Swaminathan who conveyed his objection to the commercialisation of Bt brinjal, specifically mentioning the need to test for any chronic effects of consuming Bt brinjal and preserve the existing genetic variability of brinjal; (b) Prof. Jack Heinemann^{mm} of the University of Canterbury who stated that the Bt brinjal dossier and EC-II did not meet “fundamental and even routine hazard assessment standards for molecular characterization”;⁷⁹ and (c) Prof. David Schubertⁿⁿ of the Salk Institute of Biological Studies who pointed out that the introduction of Bt brinjal would lead to the consumption of Bt toxin in much higher quantities than ever before with any GE food crops. This would be by a vast and heterogeneous population (in terms of health, age and genetic makeup), with the weak more likely to be impacted and to develop immune responses. Prof. Schubert said it was virtually certain that a large number of people eating Bt brinjal would become allergic to the foreign protein in it.⁸⁰

India is a signatory to the Cartagena Protocol on Biosafety and many scientists and civil society organizations opined

^{kk} The consultations were held between 13 January and 6 February 2010, in the following cities: Kolkata (West Bengal), Bhubaneswar (Orissa), Ahmedabad (Gujarat), Nagpur (Maharashtra), Chandigarh (Haryana & Punjab), Hyderabad (Andhra Pradesh) and Bangalore (Karnataka).

^{ll} The public consultations were attended by farmers, consumer groups, scientists, seed and biotechnology industry representatives, agriculture scientists from the government and private sector, doctors from different medical streams, students, civil society groups and concerned citizens from all walks of life.

^{mm} Prof. Jack A. Heinemann is a Professor at School of Biological Sciences, University of Canterbury and was a lead author in the IAASTD contributing to the Global and Synthesis Reports.

ⁿⁿ Prof. David Schubert is a Professor at the Salk Institute of Biological Studies, California.

that GEAC's decision to recommend the commercial cultivation of Bt brinjal without consulting all stakeholders had violated Article 23 of the Protocol. The Minister in his decision note referred to this as well as to Section 45 of the Codex Alimentarius Guidelines^{oo} about field trials of GE plants and Principle 15 of the Rio Declaration^{pp}, which calls for the Precautionary Principle to be exercised for environmental protection. He noted that the standards followed by GEAC in arriving at the decision to approve Bt brinjal did not appear to adhere to these international guidelines.⁸¹

The Minister pointed out there were viable non-pesticide management alternatives to Bt brinjal being successfully practised across two million acres in the country^{qq} and there was no overriding need for Bt brinjal. He added that India was the centre of origin of brinjal; therefore contamination would be a serious threat. He also pointed out that there was strong negative public sentiment against the prospect of Monsanto controlling the food chain in India.⁸²

3.0 EVENTS POST THE BT BRINJAL MORATORIUM

3.1 Further Independent Evaluations of Bt Brinjal

Prof. David Andow^{rr} of the University of Minnesota and Dr. Lou Gallagher,^{ss} an environmental epidemiologist and risk assessment expert submitted their reports in September 2010 and January 2011 respectively. In his exhaustive and meticulous environmental risk assessment report, Prof. Andow highlighted the following: (a) The Bt brinjal event EE-1 was an inferior and old product; (b) the scope for evaluation of Bt brinjal set by EC-II was too narrow; many of the environmental risks of Bt brinjal had not been considered; (c) the risk of monophagous pests^{tt} developing resistance was very high, but this had not been addressed nor had any risk mitigation strategies been put forward; (d) India was the centre of brinjal biodiversity with 29 wild varieties which were potentially at significant risk of contamination by Bt brinjal; (e) the Bt brinjal hybrid was not suitable for

resource-poor brinjal farmers with smallholdings; and (f) no socio-economic analysis had been done to evaluate the effects of adopting Bt brinjal.⁸³

Dr. Gallagher pointed out that the food safety studies on Bt brinjal submitted by Mahyco had not been done in accordance with Indian standards, let alone international standards, and the results had not been summarised correctly. She disclosed that the studies had found that rats fed on Bt brinjal showed organ and system damage, such as ovaries half their normal weight, enlarged spleens (indicating chronic infection), liver damage, and elevated white blood count.⁸⁴

Dr. Jack Heinemann submitted a further evaluation of Bt brinjal in late February 2012. In this evaluation, he covered issues of regulation and shared specific findings on the Bt brinjal developed by Mahyco.

He recommended that the regulatory review process involve all stakeholders including civil society right from the beginning; that risk assessment should be done through verifiable independent testing by qualified scientists independent of commercial incentive; that the process should build confidence in the assessment and reduce uncertainty; and that all data available should be reviewed (irrespective of whether it was obtained for the purposes of risk assessment or not).⁸⁵

Dr. Heinemann pointed out that the fundamental characterization of the event EE-1 had not been completed and there were significant anomalies in reporting the constructs. He opined that such fundamental discrepancies by the developer went unchallenged by the regulators and therefore, it was difficult to accept the assurance of the regulators regarding other procedures as well.⁸⁶

3.2 Indian Science Academies Lack Rigour

Post the moratorium, the Minister of Environment & Forests asked the six science academies^{uu} in India to submit a report on "Biotechnology in food crops with a focus on

^{oo} In the Codex Alimentarius guidelines for the conduct of food safety assessment of foods derived from recombinant-DNA plants, Section 45 specifies that: "The location of trial sites should be representative of the range of environmental conditions under which the plant varieties would be expected to be grown. The number of trial sites should be sufficient to allow accurate assessment of compositional characteristics over this range. Similarly, trials should be conducted over a sufficient number of generations to allow adequate exposure to the variety of conditions met in nature. To minimise environmental effects, and to reduce any effect from naturally occurring genotypic variation within a crop variety, each trial site should be replicated. An adequate number of plants should be sampled and the methods of analysis should be sufficiently sensitive and specific to detect variations in key components." (http://www.who.int/foodsafety/biotech/en/codex_guidelines_plants.pdf)

^{pp} Principle 15 of the Rio Declaration on Environment and Development states: "In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation."

(http://www.unesco.org/education/information/nfsunesco/pdf/RIO_E.PDF)

^{qq} NPM (Non-Pesticidal Management) is a practice developed to eliminate the use of pesticides in agriculture which was initiated in Andhra Pradesh, a state with very high levels of pesticide usage. Through NPM practices, farmers have maintained good yields and made better profits by eliminating the expense on pesticides. Beginning with 200 farmers in 2001, the initiative has now spread to over 1.3 million ha (3.2 million acres) of farmed land in Andhra Pradesh, accounting for more than 10% of total cultivated area of the state, spread across 7,000 villages in 22 districts and currently benefits about 1.3 million farmers.

^{rr} Prof. David Andow, an entomologist with the University of Minnesota, had sent comments on Bt brinjal to the Minister of Environment & Forests, and given his full report in September 2010 on Bt brinjal which was submitted to the Supreme Court as part of the public interest litigation on GM crops in India.

^{ss} Dr. Gallagher an environmental epidemiologist and risk assessment expert from New Zealand submitted her report on Bt brinjal in January 2011.

^{tt} Pests which feed exclusively on one type of plant or on species that are closely related.

^{uu} The Indian Academy of Sciences, National Academy of Medical Sciences, Indian National Academy of Engineering, Indian National Science Academy, National Academy of Agricultural Sciences and National Academy of Sciences.

transgenic crops". The report from the academies came out in September 2010, with a full section on Bt brinjal in which the authors recommended the "limited release" of Bt brinjal and said that they found it "safe for human consumption and that its environmental effects are negligible".⁸⁷

The Coalition for a GM-Free India^{VV} pointed out that a significant part of the section on Bt brinjal in the report had been reproduced from an article^{WW} in a biotechnology newsletter written by Dr. Ananda Kumar, a Bt brinjal developer and a member of GEAC (whose conflict of interest in being part of EC-II had been raised earlier).^{88,89} The Minister dismissed the report citing lack of scientific rigour.⁹⁰ However, the report was not withdrawn and a reworked version has been put up retaining the original recommendations.⁹¹

3.3 GEAC Meets on Bt Brinjal

GEAC held a meeting along with some experts in April 2011 to deliberate on key concerns raised during public consultations and the need for additional studies on GE food crops, protocols and procedures.⁹² Again the experts invited consisted of GE crop developers and people already involved in clearing Bt brinjal at various stages.⁹³ Civil society groups expressed strong objections to the inclusion of experts who had a conflict of interest in deciding on the future course of action regarding Bt brinjal.

3.4 Biopiracy

In February 2011, the Environment Support Group (ESG)^{XX}, based in Bangalore, filed a complaint with the Karnataka State Biodiversity Board that Mahyco (with 26% shareholding by Monsanto), and its collaborators (the University of Agriculture Sciences (UAS), Dharwad, and Sathguru Management Consultants) had violated the Biological Diversity Act 2002^{YY} by using six local varieties of brinjal for back-crossing with the Bt brinjal event EE-1, without obtaining the necessary approvals.⁹⁴ Assiduously followed up by ESG, the case was taken up by the state Biodiversity Board and finally, by the National Biodiversity Authority (NBA). The NBA, in its meeting in June 2011, decided to proceed legally against Mahyco/Monsanto and others concerned for accessing and illegally using local

brinjal varieties for the development of Bt brinjal without prior approval of the competent authorities.⁹⁵ At its meeting on 28 February 2012, the NBA, by majority vote, reaffirmed this decision.⁹⁶

3.5 Udupi Mattu Gulla Brinjal Gets GI Status

The Bt brinjal controversy prompted at least one brinjal grower community to protect its traditional brinjal variety. An application by Mattu Gulla Growers Association, facilitated by the Department of Horticulture, Karnataka, to protect their unique brinjal variety called *Udupi Mattu Gulla*^{ZZ} resulted in it getting Geographic Indication (GI) status^{aaa} in May 2011, denoting its origin in Mattu Village, Udupi, and its unique properties.^{97,98} GI status renders a formal legal identity to a variety and if the variety is modified, those who made the modification will be prevented by virtue of the GI from denying the source of origin and the grower community will be eligible for benefit sharing.

4.0 MORATORIUM: VICTORY OR REPRIEVE?

The moratorium on Bt brinjal is merely a pause or reprieve in the people's efforts to keep the country free of GE crops. Bt brinjal has not been rejected by GEAC, the apex Indian biotechnology regulating body which remains in deliberation over the next steps. Even though no new GE crops have been approved for commercial cultivation (Bt cotton being the only GE crop commercially grown in India), numerous approvals for field trials of various GE crops are being granted during every meeting of the GEAC. On the other hand, eight^{bbb} state governments have informed the Ministry of Environment & Forests that they will not allow GE field trials in their states citing human health and environmental safety concerns.^{99,100}

However, the Ministry of Science & Technology is moving a bill in Parliament for the constitution of a new regulatory body called the Biotechnology Regulatory Authority of India (BRAI). Some Members of Parliament, certain state governments, many eminent citizens including retired judges of the Supreme Court and high courts, and civil society groups/individuals have objected to the bill because it acts to facilitate the introduction of GE technology

^{VV} The Coalition for a GM-Free India is a collective of groups mostly working on sustainable agriculture, food and environment issues, prominent farmers' groups, and individuals. The coalition came into being in 2006 when the Bt brinjal issue emerged.

^{WW} The original article: Ananda Kumar, P. (2009, December). Bt Brinjal A Pioneering Push. *Biotech News*, 4(6), 108-111. Retrieved 5 September 2011 from <http://biotechnews.co.in/pdf2009/BIOTEHNEWSFINALCOPY.pdf>

^{XX} ESG is a voluntary, not for profit, public interest organization striving to defend natural resources and communities in the areas of environmental and social justice.

^{YY} The Biodiversity Act 2002 explicitly prohibits foreigners, non-resident Indians (NRIs) or foreign institutions from initiating any research involving access to the biological resources of India without prior approval from the National Biodiversity Authority (NBA).

^{ZZ} The brinjal is ovoid-shaped and green in colour with light green/white stripes. It is grown mainly in the village of Mattu and surrounding areas in Udupi District. This brinjal is known for its significance in traditional rituals, exceptional taste, and a 500-year old legend about its origins.

^{aaa} Geographical Indication (GI) registration is a certification or registration that a certain product has unique properties (qualities, processes, traditions, etc.) associated with its geographic origin. It gives the registered proprietor and authorised user/s exclusive rights to the use of the GI tag in relation to the product/goods registered.

^{bbb} The eight states that have said No to GE crop field trials are: Bihar, Madhya Pradesh, Kerala, Uttarakhand, Chattisgarh, Karnataka, West Bengal and Rajasthan.

into Indian agriculture, overrides the authority of state governments to decide on agriculture and health-related issues, does not ensure biosafety, and encompasses a conflict of interest as it will be controlled by the Ministry of Science & Technology itself, the mandate of which is to promote modern biotechnology.^{101,102} According to them, this bill, if approved, will result in a centralised, single-window clearing mechanism for GE crops.

On 9 August 2012, however, the proponents of Bt brinjal and GE crops in India experienced a serious setback. The Indian Parliamentary Standing Committee on Agriculture submitted its report to Parliament entitled “Cultivation of Genetically Modified Food Crops: Prospects and Effects”. The report examined the Bt brinjal issue at length and noted that all the tests on Bt brinjal had only been done by the promoter company or on samples provided by them, no independent testing was done; many requisite biosafety tests had not been done; and some adverse results from tests had been ignored by GEAC. In addition, the Committee pointed out that the then Co-Chair of GEAC had been under great pressure from the industry and other quarters to approve Bt brinjal and all these factors were “indicative of collusion of (the) worst kind.”¹⁰³ The Committee called for a “thorough probe” into the Bt brinjal case by reputed independent scientists and environmentalists.¹⁰⁴

Aside from this, the Committee also recommended for field trials of GM crops to be discontinued; research and development on transgenic components to be done in strict containment until the government puts in place regulatory, monitoring, oversight and surveillance mechanisms; an all-

encompassing biosafety authority to focus on biosafety, biodiversity, human and livestock health, and environmental protection; and regulation for the labeling of all GM products, including food, feed and food products; among other things.¹⁰⁵

The Committee, consisting of 31 parliamentarians representing various parties, unanimously signed off on the report, produced after two and half years of work which included regular meetings, examining documents, interviewing various stakeholders, and visiting different parts of the country for first-hand investigation.

5.0 THE ROLE OF CIVIL SOCIETY

Since 2005, prominent national farmers’ groups, consumer groups, grassroots groups, CSOs and numerous concerned individuals have been deeply involved in the Bt brinjal issue in India. The struggle is not over. Civil society action has ranged from raising public awareness to engaging the regulators and going to court. Laws and legal processes were availed in the process and media stories about these initiatives resulted in people and state governments becoming more aware about the issue of the safety of GE crops.

Broad coalitions were formed around the issue, bringing together concerned parties. These coalitions became crucial platforms for information sharing, capacity building, and multiple events and took the campaign to the national level, something small grassroots groups and individuals could not have managed to do on their own. One such coalition



Vivek Cariappa (left), a well-known organic farmer and A. S. Anand (right), Chairman of the Karnataka State Organic Farming Mission, voicing their opposition to Bt brinjal at the Bangalore Public Consultation on Bt brinjal (6 February 2010)

(Photo courtesy of Gandai Srikanta)

with Pan-Indian reach is the Coalition for a GM-Free India and another coalition formed in the southern states is the South Against Genetic Engineering (SAGE).

5.1 Taking Proactive Measures

Civil society did not accept the (corporate) scientific information endorsed by the regulators, but critiqued it, got it evaluated independently and gathered information and additional evidence from scientific studies, and other literature. They broadened the debate to include socio-economic issues and the real concerns of farmers and consumers. The underlying principle was that the decision on the commercialization of Bt brinjal went beyond the technical as it concerned fundamental issues of life and livelihood and therefore was not the prerogative of scientists or regulators alone.

The Bt brinjal campaign also resulted in educating many members of the public on GE crops. If not for the broad-based sharing of information, the public at large would have remained unaware about Bt brinjal and GE crops in general. The information sharing resulted in broad-based involvement by Indian citizens in the campaign.

Under the Indian constitution, states have jurisdiction over agriculture and can make decisions pertaining to it. Therefore, in addition to reaching out to the central government, groups and individuals reached out to their state governments as well.

6.0 GLOBAL BIOSAFETY!

The Bt brinjal saga in India has probably been one of the bigger battles against GE crops in the world in terms of intensity, duration, depth of investigation, scale, and the number of people and sectors involved. The spectre of food scarcity and hunger is the narrative put forward by the biotechnology companies to railroad governments and the public into accepting GE crops.

The global political climate vests agri-transnational corporations and their scientists with immense power. Under the banner of 'science and progress', the people's rights over natural resources, food choices and food sovereignty are suppressed and violated.

However, credible international reports have time and again reiterated that this is a false narrative. The International Assessment of Agricultural Knowledge, Science and Technology for Development' (IAASTD)^{ccc} concluded that development and sustainability can be achieved through empowering small-scale farmers to be good stewards of natural resources who can manage pests and disease

through culturally appropriate and ecologically friendly methods.¹⁰⁶

This report did not envisage a significant role for GE crops for ensuring food security. The United Nations Special Rapporteur on the Right to Food released a report in March 2011, which concluded that agro-ecological practices can improve farm productivity and increase farm incomes while reversing genetic erosion and species loss.¹⁰⁷ On the same note, one of the factors which was seen to have influenced the Minister's decision to impose the moratorium was the existence of a viable alternative in the form of Non-Pesticidal Management (NPM) successfully being practised on over three million acres in the country.

The ongoing Bt brinjal campaign in India has shown the importance of wide information dissemination and public exchanges/networking as well as the need to revive and promote sustainable, safe and viable farming practices for food security.

What happened and is happening in India with regard to Bt brinjal and other GE crops is not unique to the country. Similar challenges are faced in other Asian countries. China has been growing Bt cotton for over a decade and an increase in secondary pests has been reported.¹⁰⁸ Meanwhile, the Philippines has approved Bt corn, herbicide-tolerant (HT) corn, and the stacked Ht/Bt corn—it is the only country in Asia to do so.¹⁰⁹

The country is also field-testing Bt brinjal and Golden Rice. India's GE stance also impacts other countries for instance, the export of Bt cotton seed from India to Pakistan. Armed with the biosafety dossier prepared by Mahyco, which was not subject to independent testing and not approved by the Indian government, the promoters of Bt brinjal continue to seek regulatory approval for the commercial release of the transgenic vegetable in Bangladesh and the Philippines despite serious objections and resistance from consumer, farmer, and civil society groups in these countries.¹¹⁰

In this respect, coordinating public campaigns in the different Asian countries and creating an Asian coalition to promote responsible science and biosafety in the area of food and agriculture would be an essential step forward for the region. The current paradigm with respect to GE crops is based on the concept of 'substantial equivalence'^{ddd} whereas national biosafety laws should be stringent and supported by internationally accepted protocols based on the Precautionary Principle, public consultation and human rights with the onus on the proponents of GE crops to provide 'evidence of safety'¹¹¹ of the technology. Citizens from all walks of life must be more vigilant, united, steadfast and proactive in asserting their food sovereignty rights and insisting on safe food for all.

^{ccc}The IAASTD was a unique effort initiated by the World Bank in partnership with the United Nations Food and Agriculture Organisation (FAO), United Nations Development Programme (UNDP), United Nations Environmental Programme (UNEP), the World Health Organisation (WHO) and representatives from governments, civil society, private sector and scientific institutions from around the world, mandated to evaluate the agrarian reality of today and provide suggestions and guidance for political and economic choices to create sustainable agricultural economies in the future.

^{ddd}A concept developed by the Organisation for Economic Co-operation and Development (OECD) in 1991 stating that if a novel food or food component is found to be substantially equivalent to an existing food or food component, it can be treated in the same manner with respect to food safety (Joint FAO/WHO Biotechnology and Food Safety Report, 1996).

Bt Brinjal in India: Chronology of Events

2000	<i>Transformation and breeding for integration of Cry1Ac gene into brinjal hybrids by Mahyco</i>
2001-2002	<i>Preliminary green house evaluation to study growth, development & efficacy</i>
2002-2004	<i>Confined field trials to study pollen flow, germination, aggressiveness, weediness & biochemical, toxicity and allergenicity</i>
2004	<i>RCGM approves multi-location research trials (MLRTs) of seven Bt brinjal hybrids of Mahyco</i>
2005	<i>Through ABSP-II MOU Mahyco sub-licenses event EE-1 to TNAU, UAS, IIVR</i>
2006	<i>February: Greenpeace, followed by Gene Campaign, seek Bt brinjal biosafety data through RTI March: CSA brings out a report of biosafety violations in a Bt brinjal trial in Kurnool district, AP May: Mahyco submits biosafety data from MLRTs & seeks permission for large scale field trials (LSTs) June : Civil society gives feedback to GEAC pointing out the inadequacy of the data and other fundamental issues related to Bt brinjal June: GEAC posts only summary of test results of Bt brinjal on MoEF website August: GEAC appoints an expert committee (EC-I) to look into Bt brinjal biosafety September: Supreme Court halts all new field trials in response to interim appeal in PIL on GE crops October : Independent expert committee appointed by civil society releases report</i>
2007	<i>February: Supreme Court orders biosafety data of GE crops under trials to be put in the public domain July: EC-I submits report, recommends additional studies but gives go ahead for LSTs of Bt brinjal hybrids August: GEAC approves LSTs for seven Bt brinjal hybrids of Mahyco January & November: Central Information Commissioner (CIC) orders twice that Bt brinjal biosafety data be made public, in response to Greenpeace RTI; however, GEAC defies orders</i>
2007-2008	<i>Two-year LSTs of Bt brinjal conducted: pollen flow, soil microflora, crossability & baseline susceptibility studies conducted</i>
2008	<i>May: More than a thousand citizens protest at New Delhi against second year LSTs of Bt brinjal August onwards: Civil society launches I AM NO LAB RAT campaign against Bt brinjal; Poison on the Platter- documentary film launched in various cities of India; brinjal festivals held; petitions and postcards sent to the Health Minister & Prime Minister. August : In compliance with SC orders of 2007, GEAC uploads complete (raw) biosafety data of Bt brinjal on the MoEF website December: The then Minister of Health & Family Welfare Dr. Anbumani Ramadoss opposes Bt brinjal</i>
2009	<i>January-February: Independent expert Prof. Séralini submits report followed by Dr. Carmen, Dr. Doug Gurian-Sherman, Prof. Jack Heinemann and others critique Mahyco's biosafety dossier on Bt brinjal January: Data from Bt brinjal LSTs submitted to GEAC May: Expert Committee (EC-II) constituted to evaluate Bt brinjal biosafety data, reports from independent scientists and other feedback 8 October: EC-II submits report recommending release of Bt brinjal 14 October: GEAC recommends Bt brinjal for commercial release 15 October: Minister of Environment & Forests makes EC-II report public, decides to hold public consultations and seeks feedback on EC-II report</i>
2009-2010	<i>December- February: Independent scientists appraise Bt brinjal dossier & ECII report and submit reports to the Minister of Environment & Forests November- February: 11 states say No to Bt brinjal</i>
2010	<i>12 January - 6 February: Public consultations in Kolkata, Bhubaneswar, Ahmedabad, Nagpur, Chandigarh, Hyderabad and Bangalore see massive opposition to Bt brinjal from all sections of the society. 9 February: Minister of Environment & Forests, Mr. Shri Jairam Ramesh, declares moratorium on Bt brinjal September: The discredited inter-academy report favouring release of Bt brinjal is rejected by the Minister of Environment & Forests September: Prof. David Andow submits his environmental risk assessment on Bt brinjal</i>
2011	<i>January: Dr. Lou Gallagher submits report on Bt brinjal April : GEAC holds its first meeting on Bt brinjal with selected experts June: National Biosafety Authority (NBA) decides to take legal action against Mahyco, Monsanto & collaborators for violation of Biological Diversity Act 2002 August: Mattu Gulla brinjal from Udippi, Karnataka state gets Geographic Indication (GI) status August: Mahyco, Monsanto & collaborators indicted by NBA for genetically engineering native brinjals varieties without approval. (bio-piracy)</i>
2012	<i>February: Dr. Jack Heinemann submits a further analysis of Bt brinjal and guidelines for safety testing of GMOs April: The NBA reaffirms its decision to prosecute Mahyco, Monsanto & collaborators August: Indian Parliamentary Standing Committee on Agriculture releases "Cultivation of Genetically Modified Crops—Prospects and Effects". Recommends thorough investigation into the approval process of Bt brinjal and a halt to all field trials of GE crops in the country.</i>

Abbreviations

<i>Bt</i>	<i>Bacillus thuringiensis</i> (soil organism)
<i>Bt brinjal</i>	<i>Brinjal engineered with an endotoxin gene from Bacillus thuringiensis.</i>
<i>GE</i>	<i>Genetic Engineering</i>
<i>GEAC</i>	<i>Genetic Engineering Appraisal Committee</i>
<i>MLRTs</i>	<i>Multi Level Research Trials</i>
<i>MoEF</i>	<i>Ministry of Environment & Forests</i>
<i>LSTs</i>	<i>Large Scale Trials</i>
<i>RCGM</i>	<i>Review Committee for Genetic Manipulation</i>

REFERENCES

- 1 MoEF (Ministry of Environment and Forests). (2010, February 9). Decision on commercialization of Bt brinjal. MoEF. New Delhi. India. Retrieved September 4, 2011 from http://moef.nic.in/downloads/public-information/minister_REPORT.pdf
- 2 MoEF (Ministry of Environment and Forests). (1989, December 5). Rules for the manufacture, use, import, export and storage of hazardous micro organisms genetically engineered organisms or cells. MoEF. New Delhi. India. Retrieved September 4, 2011 from <http://www.moef.nic.in/legis/hsm/hsm3.html>
- 3 Press Information Bureau. (2001, November 1). Genetic Engineering Approval Committee meets on Bt cotton. Press Information Bureau. New Delhi. India. Retrieved November 3, 2011 from <http://pib.nic.in/archieve/lreleng/lyr2001/rnov2001/01112001/r011120017.html>
- 4 Scones, I. (2003). Regulatory manoeuvres: the Bt cotton controversy in India. Institute of Development Studies. Sussex. England. Retrieved September 4, 2011 from <http://www.ids.ac.uk/files/Wp197.pdf>
- 5 Kranti, K. (2011, June 8). 10 Years of Bt in India. Cotton International. Retrieved October 20, 2011 from <http://www.cotton247.com/news/?storyid=2160>.
- 6 Indian GMO Research Information System (IGMORIS). Database: Biosafety data of approved Genes/Events of GM Cotton. IGMORIS. Retrieved January 10, 2012 from http://igmoris.nic.in/major_developments1.asp
- 7 Indian GMO Research Information System (IGMORIS). Yearwise list of commercially released varieties of Bt cotton hybrids by GEAC. IGMORIS. Retrieved January 10, 2012 from http://igmoris.nic.in/commercial_approved.asp
- 8 Koshy, J. (2011, July 27). How India became a Bt Cotton country. Mint. Retrieved November 1, 2011 from <http://www.livemint.com/2011/07/27143545/How-India-became-a-Bt-Cotton-c.html>
- 9 Indian GMO Research Information System (IGMORIS). FIELD TRIALS OF GM CROPS (CONTAINING NEW GENES/EVENTS). IGMORIS. http://igmoris.nic.in/field_trials.asp
- 10 Jishnu, L. & Sood, J. (2011, May 15-31). Who is watching GM crops?. Down To Earth. New Delhi. India. Retrieved September 4, 2011 from <http://www.downtoearth.org.in/content/who-watching-gm-crops>
- 11 Indian GMO Research Information System (IGMORIS). Biosafety data of approved Genes/Events of GM Cotton. Retrieved January 10, 2012 from http://www.igmoris.nic.in/field_trials.asp
- 12 Sahai, S. (2009). Mahyco's GM rice contaminates natural rice in Jharkhand. Gene Campaign. New Delhi. India. Retrieved August 30, 2011 from <http://www.gene-campaign.org/Publication/Pressrelease/GM-Rice-contaminates-JK-Jan-20-9.html>
- 13 Karnataka Rajya Raitha Sangha (2010). Karnataka farmers say no to unsafe DuPont GM rice field trials. La Via Campesina South Asia. Retrieved September 4, 2011 from <http://lvcsouthasia.blogspot.com/2010/11/karnataka-farmers-say-no-to-unsafe.html>
- 14 Centre for Sustainable Agriculture. (2005, February). The story of Bt cotton in Andhra Pradesh: Erratic processes and results. Centre for Sustainable Agriculture. Retrieved March 30, 2012 from <http://indiagminfo.org/wp-content/uploads/2011/11/The-Story-of-Bt-Cotton-in-Andhra-Pradesh.pdf>
- 15 Qayum, A. & Sakhari, K. (2006). False Hopes, Festering Failures. Deccan Development Society. Retrieved March 20, 2012 from <http://indiagminfo.org/wp-content/uploads/2011/11/APCIDD-report-bt-cotton-in-AP-2005-06.pdf>
- 16 ANTHRA, Sheep, A.P. & Goat Federation. (2007, February). Preliminary Assessment study on sheep mortality grazing on Bt-cotton fields in Warangal district, Andhra Pradesh- February 2nd 2007.
- 17 Business Standard. (2006, May). MRTPC raps Monsanto over Bt cotton royalty. Business Standard. Retrieved March 20, 2012 from <http://www.business-standard.com/india/news/mrtpc-raps-monsanto-over-bt-cotton-royalty/244620/>
- 18 Monsanto. (2010, May 5). Cotton in India. Retrieved August 22, 2011, from <http://www.monsanto.com/newsviews/Pages/india-pink-bollworm.aspx>
- 19 Ranjith, M.T., Prabhuraj, A., Srinivasa, Y.B. (2010). Survival and reproduction of natural populations of *Helicoverpa armigera* on Bt-cotton hybrids in Raichur, India. Current Science, 99(11), 1602-1606. Retrieved September 4, 2011, from <http://www.ias.ac.in/currensci/10dec2010/1602.pdf>
- 20 Kranthi, K.R. (2011, May). Part II: 10 years of Bt in India. Cotton 24/7. Retrieved March 20, 2012 from <http://www.cotton247.com/news/?storyid=2160>.

- cotton247.com/marketplace/sustainability/?storyid=2159
- 21 Kranthi, K.R. (2010). Bt Cotton: A critical appraisal. Annexure to Bt brinjal decision note. MoEF (Ministry of Environment and Forests). New Delhi. India. Retrieved September 4, 2011 from http://moef.nic.in/downloads/public-information/Annex_BT.pdf.
- 22 Jishnu, L. (2011, July 31). Cotton saga unravels. Down to Earth. New Delhi. India. Retrieved November 1, 2011 from <http://www.downtoearth.org.in/content/cotton-saga-unravels>.
- 23 Kranthi, K.R. (2011, May). Part II: 10 years of Bt in India. Cotton 24/7. Retrieved March 20, 2012 from <http://www.cotton247.com/marketplace/sustainability/?storyid=2159>
- 24 Coalition for a GM-Free India. (2012, March). 10 years of Bt cotton: false Hype and failed promises. Retrieved March 30, 2012 from <http://indiagminfo.org/wp-content/uploads/2012/03/Bt-Cotton-False-Hype-and-Failed-Promises-Final.pdf>
- 25 National Institute of Rural Development. (2012, January). Bt Cotton and Beyond. Retrieved March 30, 2012 from <http://www.ddsindia.com/www/pdf/B&B%20Report.pdf>
- 26 Sainath, P. (2011, October). Maharashtra leads in the statistic of shame. The Hindu. Retrieved March 20, 2012 from <http://www.thehindu.com/opinion/columns/sainath/article2577740.ece>
- 27 Ministry of Environment and Forests (MoEF) & Department of Biotechnology, Ministry of Science and Technology. (n.d.). Biology of Brinjal. MoEF. New Delhi. India. Retrieved August 22, 2011 from <http://dbtbio-safety.nic.in/guidelines/brinjal.pdf> <http://dbtbiosafety.nic.in/guidelines/brinjal.pdf>
- 28 *ibid*
- 29 Ministry of Environment and Forests (MoEF) & Centre for Environment Education. (2010). National Consultations on Bt Brinjal-A primer on concerns, issues and prospects. MoEF. New Delhi. India. Retrieved September 4, 2011 from <http://moef.nic.in/downloads/public-information/Bt%20Brinjal%20Primer.pdf>
- 30 Andow, D. (2010). Bt Brinjal event EE-1: The Scope and Adequacy of the GEAC environmental and risk assessment. http://www.gmwatch.eu/files/Andow_Report_Bt_Brinjal.pdf
- 31 GEAC, Expert Committee (EC-II). (2009, October). Report of the Expert Committee (EC-II) on Bt Brinjal Event EE-1. MoEF (Ministry of Environment and Forests). New Delhi. India. Retrieved September 6, 2011 from <http://moef.nic.in/downloads/public-information/Report%20on%20Bt%20brinjal.pdf>
- 32 *ibid*
- 33 Ministry of Environment and Forests (MoEF) & Centre for Environment Education. (2010). National Consultations on Bt Brinjal-A primer on concerns, issues and prospects. MoEF. New Delhi. India. Retrieved September 4, 2011 from <http://moef.nic.in/downloads/public-information/Bt%20Brinjal%20Primer.pdf>
- 34 GEAC, Expert Committee (EC-II). (2009, October). Report of the Expert Committee (EC-II) on Bt Brinjal Event EE-1. MoEF (Ministry of Environment and Forests). New Delhi. India. Retrieved September 4, 2011 from <http://moef.nic.in/downloads/public-information/Report%20on%20Bt%20brinjal.pdf>
- 35 Agricultural Biotechnology Support Project-II (n.d). About the Bt brinjal project. ABSP-II. Retrieved August 22, 2011 from http://www.absp2.net/index.php?option=com_content&view=article&id=73&Itemid=133
- 36 ISAAA. 2009. Global Status of Commercialized Biotech/GM Crops: 2009 - The first fourteen years, 1996 to 2009.
- 37 Finamore, A. et al. (2008). Intestinal and Peripheral Immune Response to MON810 Maize Ingestion in Weaning and Old Mice. *Journal of Agricultural and Food Chemistry*.
- 38 Séralini, G.-E., Mesnage, R., Clair, E., Gress, S., de Vendômois J.S. & Cellier, D. (2011). Genetically modified crops safety assessments: present limits and possible improvements. *Environmental Sciences Europe*, 23(10).
- 39 Gendel, S.M. (1998b). The use of amino acid sequence alignments to assess potential allergenicity of proteins used in genetically modified foods. *Advances in Food and Nutrition Research*, 42, 44-61.
- 40 Gupta, A. et al. (2005). Impact of Bt Cotton on Farmers' Health (in Barwani and Dhar District of Madhya Pradesh). Investigation Report Oct – Dec 2005. http://www.gmwatch.eu/index.php?option=com_content&view=article&id=1660:impact-of-bt-cotton-on-farmers-health-part-1- and http://indiagminfo.org/?page_id=238
- 41 Aris, A. & Leblanc, S. (2011). Maternal and fetal exposure to pesticides associated to genetically modified foods in Eastern Townships of Quebec, Canada. *Reproductive Toxicology*, 31(4), 528-33.
- 42 Genetic Engineering Approval Committee. (2006, May 2). Decisions taken in the 66th Meeting of the Genetic Engineering Approval Committee held on 2.05.2006. MoEF (Ministry of Environment and Forests). New Delhi. India. Retrieved September 6, 2011 from <http://moef.nic.in/divisions/csurv/geac/geac-66.pdf>
- 43 Centre for Sustainable Agriculture (2006, March 3). Field Trials of [Mahyco's] Bt Rice and Bt Brinjal in Farmers' Fields in Andhra Pradesh- A CSA report from the field. Global Sisterhood Network. Retrieved August 25, 2011 from <http://www.global-sisterhood-network.org/content/view/782/76/>
- 44 Genetic Engineering Approval Committee. (2006, May 22). Decisions taken in the 67th Meeting of the Genetic Engineering Approval Committee held on 22.05.2006. MoEF. New Delhi. India. Retrieved September 6, 2011 from <http://moef.nic.in/divisions/csurv/geac/geac-67.pdf>
- 45 Genetic Engineering Approval Committee. (2006, June 1). Decisions taken in the 68th Meeting of the Genetic Engineering Approval Committee held on 01.06.2006. MoEF (Ministry of Environment and Forests). New Delhi. India. Retrieved September 6, 2011 from <http://moef.nic.in/divisions/csurv/geac/geac-68.pdf>
- 46 Coalition for a GM-Free India. (2006, June 14).

- Feedback on Bt brinjal: Biosafety and beyond. IndiaGMInfo. Retrieved November 5, 2011 from http://indiagminfo.org/?page_id=51
- 47 Genetic Engineering Approval Committee. (2006, June 30). Decisions taken in the 69th Meeting of the Genetic Engineering Approval Committee held on 30.06.2006. MoEF (Ministry of Environment and Forests). New Delhi. India. Retrieved September 6, 2011 from <http://moef.nic.in/divisions/csurv/geac/geac-69.pdf>
- 48 Jishnu, L. (2008, July 5). Gaping holes in regulation of GM crops. Business Standard. Retrieved August 28, 2011 from <http://www.business-standard.com/india/news/latha-jishnu-gaping-holes-in-regulationgm-crops/327852/>
- 49 Coalition for GM- Free India (2006, September 12). Expert panel on Bt brinjal criticized. Lobby Watch. Retrieved November 17, 2011 from <http://www.lobbywatch.org/archive2.asp?arcid=7024>
- 50 Genetic Engineering Approval Committee, Expert Committee (EC1). (2007, July 2). Minutes of the 2nd meeting of the Expert Committee on Bt brinjal, 3/7/2007. MoEF (Ministry of Environment and Forests). New Delhi. India. Retrieved September 6, 2011 from http://www.moef.nic.in/divisions/csurv/bt_brinjal.pdf
- 51 Supreme Court of India Order. (2006, September 22). Orders of Proceedings, Writ petition no 260 of 2005. SC of India. New Delhi. India.
- 52 Supreme Court of India Order. (2008, February 13). Orders of Proceedings, Writ petition no 260 of 2005. SC of India. New Delhi. India. Retrieved September 6, 2011 from http://www.moef.nic.in/divisions/csurv/geac/Hon%27ble_SC_order_13.2.2008.pdf
- 53 Genetic Engineering Approval Committee. (2008, April 2). Decisions taken in the 83rd Meeting of the Genetic Engineering Approval Committee held on 2.4.2008. MoEF (Ministry of Environment and Forests). New Delhi. India. Retrieved September 6, 2011 from <http://www.envfor.nic.in/divisions/csurv/geac/decision-dec-83.pdf>
- 54 Genetic Engineering Approval Committee. (2008, May 28). Decisions taken in the 85th Meeting of the Genetic Engineering Approval Committee held on 28.5.2008. MoEF (Ministry of Environment and Forests). New Delhi. India. Retrieved September 6, 2011 from <http://moef.nic.in/divisions/csurv/geac/decision-june-85.pdf>
- 55 Supreme Court Order of India. (2007, May 8). Order of Proceedings, Writ petition No 260 of 2005. SC of India. New Delhi. India. Retrieved September 6, 2011 from http://www.moef.nic.in/divisions/csurv/geac/writ_petition.pdf
- 56 The Independent Expert Committee. (2006, October). Report of the Independent Expert Committee on Bt Brinjal. IndiaGMInfo. Retrieved September 6, 2011 from http://indiagminfo.org/wp-content/uploads/2011/08/IEC_report_on_Bt_brinjal_csa-thanal1.pdf
- 57 Genetic Engineering Approval Committee, Expert Committee (EC1). (2007, July 2). Minutes of the 2nd meeting of the Expert Committee on Bt brinjal, 3/7/2007. MoEF (Ministry of Environment and Forests). New Delhi. India. Retrieved September 6, 2011 from http://www.moef.nic.in/divisions/csurv/bt_brinjal.pdf
- 58 Genetic Engineering Approval Committee, Expert Committee (EC1). (2007, July 2). Minutes of the 2nd meeting of the Expert Committee on Bt brinjal, 3/7/2007. MoEF (Ministry of Environment and Forests). New Delhi. India. Retrieved September 6, 2011 from http://www.moef.nic.in/divisions/csurv/bt_brinjal.pdf
- 59 Genetic Engineering Approval Committee. (2007, August 8). Decisions taken in the 79th Meeting of the Genetic Engineering Approval Committee held on 8.8.2007. MoEF (Ministry of Environment and Forests). New Delhi. India. Retrieved September 6, 2011 from <http://moef.nic.in/divisions/csurv/geac/geac-aug-79.pdf>
- 60 Singh, R. (2011). Locating Publics: Co-Production of the Bt brinjal Controversy and the Publics in India. Unpublished master's thesis, Maastricht University, The Netherlands.
- 61 *ibid*
- 62 IANS (Indo-Asian News Service). (2008, December 16). GM crops: Environment Ministry proposes, Ramadoss opposes. India Today. Retrieved September 10, 2011 from <http://indiatoday.intoday.in/story/GM+crops:+environment+ministry+proposes,+Ramadoss+opposes/1/22717.html>
- 63 Burcher, S. (2009, February 9). Bt brinjal unfit for consumption. Institute of Science in Society. Retrieved September 2, 2011 from http://www.i-sis.org.uk/Bt_Brinjal_Unfit.php
- 64 Seralini G.E. (2009, January). Effects on health and Environment of Transgenic (or Gm) Bt Brinjal. Retrieved September 6, 2011 from http://indiagminfo.org/wp-content/uploads/2011/09/BtBrinjal-GES_-final-final-final.pdf
- 65 Carmen, J. (2009, January). A review of Mahyco's GM Brinjal food safety studies. Retrieved September 6, 2011 from <http://indiagminfo.org/wp-content/uploads/2011/09/prof-judy-carman-bt-brinjal.pdf>
- 66 Gurian-Sherman, D. (2009). No proper testing for Bt brinjal gene flow. GMWatch. Retrieved September 9, 2011 from http://www.gmwatch.org/index.php?option=com_content&view=article&id=11611:gene-flow-testing-for-bt-brinjal-useless-expert
- 67 MoEF (Ministry of Environment and Forests). (2009, January 14). Decisions taken in the 91st Meeting of the Genetic Engineering Approval Committee held on 14.01.2009. MoEF. New Delhi. India. Retrieved September 6, 2011 from <http://moef.nic.in/divisions/csurv/geac/decision-jan-91.pdf>
- 68 MoEF (Ministry of Environment and Forests). (2009, May 29). Constitution of the Expert Committee to review the findings of the large scale trials and other related bio-safety studies on Bt brinjal. India. MoEF. New Delhi. India. Retrieved September 6, 2011 from http://www.moef.nic.in/divisions/csurv/geac/cons_exp_committee.pdf
- 69 GEAC, Expert Committee (EC-II). (2009, October). Report of the Expert Committee (EC-II) on Bt Brinjal Event EE-1. MoEF (Ministry of Environment and Forests). New Delhi. India. Retrieved September 6, 2011 from <http://moef.nic.in/downloads/public-information/Report%20>

on%20Bt%20brinjal.pdf

- 70 Genetic Engineering Approval Committee. (2009, October 14). Decisions taken in the 97th Meeting of the Genetic Engineering Approval Committee held on 14.10.2009. MoEF (Ministry of Environment and Forests). New Delhi. India. Retrieved September 6, 2011 from <http://moef.nic.in/divisions/csurv/geac/decision-oct-97.pdf>
- 71 MoEF (Ministry of Environment and Forests). (2009, October 15). Decision on Bt –Brinjal after satisfactory consultations with all stakeholders: Jairam Ramesh. MoEF. New Delhi. India. Retrieved September 9, 2011 from <http://www.pib.nic.in/newsite/erelease.aspx?relid=53217>
- 72 Coalition for a GM-Free India. (2009, November). Is this what Indians should be trusting? - The story of the Expert Committee that recommended Bt Brinjal for commercial cultivation in India. GMWatch. Retrieved September 10, 2011 from http://www.gmwatch.org/index.php?option=com_content&view=article&id=11876:is-this-what-indians-should-be-trusting-the-story-of-the-expert-committee-that-recommended-bt-brinjal.
- 73 Chaudhury, S. (2010, March 6). The gene gun at your head. Tehelka. Tehelka Magazine, 7(09). Retrieved September 5, 2011 from http://www.tehelka.com/story_main44.asp?filename=Ne060310coverstory.asp&id=1.
- 74 Mohanty, D. (2009, October 23). Orissa bans Bt brinjal citing small farmers' interests and biosafety concerns. Indian Express. Retrieved October 17, 2011 from <http://www.indianexpress.com/story-print/532123/>
- 75 Government of Kerala. (2008, April). Kerala reiterates its no to GM crops and foods. Kerala Biodiversity Board, Kerala. Retrieved September 9, 2011 from <http://www.keralabiodiversity.org/pdf/gmcrops260408.pdf>
- 76 MoEF (Ministry of Environment and Forests). (2010, February 9). Decision on commercialization of Bt Brinjal. MoEF. New Delhi. India. Retrieved September 6, 2011 from http://moef.nic.in/downloads/public-information/minister_REPORT.pdf.
- 77 The Hindu. (2011, February 10). It's a moratorium on Bt brinjal: Jairam. The Hindu. Retrieved November 3, 2011 from <http://www.hindu.com/2010/02/10/stories/2010021058000100.htm>
- 78 MoEF (Ministry of Environment and Forests). (2010, February 9). Annexure to Bt brinjal decision note. MoEF. New Delhi. India. Retrieved September 9, 2011 from http://moef.nic.in/downloads/public-information/Annex_BT.pdf
- 79 Heinemann, J. (2009, November 24). Letter to Mr. Jairam Ramesh. IndiaGMInfo. Retrieved October 20, 2011 from http://indiagminfo.org/?page_id=90.
- 80 Schubert, D. (2009, November 18). Letter to Mr. Jairam Ramesh. IndiaGMInfo. Retrieved October 20, 2011 from <http://indiagminfo.org/wp-content/uploads/2011/09/India-letter-david-schubert.pdf>
- 81 MoEF (Ministry of Environment and Forests). (2010, February 9). Decision on commercialization of Bt Brinjal. MoEF. New Delhi. India. Retrieved March 30, 2012 from http://moef.nic.in/downloads/public-information/minister_REPORT.pdf.
- 82 MoEF (Ministry of Environment and Forests). (2010, February 9). Decision on commercialization of Bt Brinjal. MoEF. New Delhi. India. Retrieved September 6, 2011 from http://moef.nic.in/downloads/public-information/minister_REPORT.pdf
- 83 Andow, D. (2010). Bt Brinjal event EE-1: The Scope and Adequacy of the GEAC environmental and risk assessment. GMWatch. Retrieved September 6, 2011 from http://www.gmwatch.eu/files/Andow_Report_Bt_Brinjal.pdf.
- 84 Gallagher, L. (2010). Bt Brinjal Event EE-1: The Scope and Adequacy of the GEAC Toxicological Risk Assessment. TestBiotech. Retrieved September 6, 2011 from http://www.testbiotech.de/sites/default/files/Report%20Gallagher_2011.pdf
- 85 Heinemann, J. A. (2012, February 27). Suggestions on how to apply international safety testing guidelines for genetically modified organisms. Centre for Integrated Research in Biosafety. University of Canterbury. Christchurch, New Zealand.
- 86 *ibid*
- 87 Vijayan, M., Datta, A., Goel, P.S., Rai, M., Sood, A.K., Talwar, K.K. (2010, September). Inter-Academy report on GM crops. http://www.downtoearth.org.in/dte/userfiles/images/GM_crops_report.pdf
- 88 Jishnu, L. (2010, October 31). How competent is Indian Science?. Down to Earth. Retrieved September 5, 2011 from <http://www.downtoearth.org.in/node/2069>.
- 89 Shetty, P. (2010, September 29). Plagiarism plagues India's genetically modified crops. Nature. Retrieved September 5, 2011 from <http://www.nature.com/news/2010/100929/full/news.2010.503.html>
- 90 Sinha, A. (2010). No scientific rigour in report on GM crops: Ramesh. Indian Express. Retrieved January 20, 2012 from <http://www.indianexpress.com/news/No-scientific-rigour-in-report-on-GM-crops--Ramesh/689268>
- 91 Vijayan, M., Datta, A., Goel, P.S., Rai, M., Sood, A.K., Talwar, K.K. (2010, December). Inter-Academy report on GM crops (Updated). Retrieved September 5, 2011 from <http://insaindia.org/pdf/Updated%20Inter%20Academy%20Report%20on%20GM%20crops.pdf>
- 92 MoEF (Ministry of Environment and Forests). (2011, April 27). Minutes of the meeting of the Genetic Engineering Appraisal Committee (GEAC) held on 27.04.2011. MoEF. New Delhi. India. Retrieved September 5, 2011 from <http://www.moef.nic.in/divisions/csurv/geac/spcl-MoM.pdf>
- 93 Venkateswaralu, K. (2009, December 4). New twist to controversy over commercial release of Bt brinjal. The Hindu. Retrieved August 28, 2011 from <http://www.thehindu.com/news/national/article60225.ece>
- 94 Environment Support Group (2010, February 15). Violation of Biological Diversity Act, 2002 in matters relating to access and utilisation of local brinjal varieties for development of Bt Brinjal by M/s Mahyco and ors. and related issues. Retrieved September 5, 2011 from <http://www.esgindia.org/sites/default/files/campaigns/brinjal/press/esg-karbioboard-btbrinjal-petition-12021.pdf>

- 95 National Biodiversity Authority (2011, June 20). Proceedings of the 20th Authority Meeting. Retrieved September 2, 2011 from http://www.nbaindia.org/docs/20th_Proceedings_10_08_2011.pdf
- 96 Verma, S. (2012, April 17). Bt brinjal row: National Biodiversity Authority decides to prosecute Monsanto. India Today. New Delhi. India. Retrieved April 17, 2012 from <http://indiatoday.intoday.in/story/bt-brinjal-row-monsanto-to-pay-for-biodiversity-violation/1/184824.html>
- 97 Naik, M.G. (2011, August 16). Udupi Gulla gets patent protection. Deccan Herald. Retrieved September 10, 2011 from <http://www.deccanherald.com/content/89223/udupi-gulla-gets-patent-protection.html>
- 98 Government of India. (2011, May 3). Geographical Indications Journal No. 40. Geographical Indications Registry. Chennai. India. Retrieved November 5, 2011 from http://www.ipindia.nic.in/girindia/journal/Journal_40.pdf
- 99 Jishnu, L. & Sood, J. (2011, May 31). Who is watching GM crops? States say No to GM. Down To Earth. Retrieved August 28, 2011 from <http://www.downtoearth.org.in/content/states-say-no-gm>
- 100 Jishnu, L. (2012, March 31). Rajasthan bans GM trials. Down to Earth. Retrieved March 31, 2012 from <http://www.downtoearth.org.in/content/rajasthan-bans-gm-trials>
- 101 Coalition for GM-Free India. (2011, August 25). India's GM bill "anti-people, anti-nature". GMWatch. Retrieved September 10, 2011 from http://www.gmwatch.org/index.php?option=com_content&view=article&id=13373:indias-gm-bill-qanti-people-anti-natureq
- 102 Dogra, B. (2011, September 10). Why we oppose Biotechnology Regulation Bill. Mainstream. Retrieved September 5, 2011 from <http://www.mainstreamweekly.net/article3001.html>.
- 103 Committee on Agriculture (2011-2012). (2012, August 9). Cultivation of genetically modified food crops: prospects and effects. Ministry of Agriculture. New Delhi. India. Retrieved August 12, 2012 from http://164.100.47.134/lssccommittee/Agriculture/GM_Report.pdf
- 104 Ibid.
- 105 Ibid.
- 106 International Assessment of Agricultural Knowledge, Science and Technology for Development. (2008, April). Agriculture at a Crossroads. Retrieved September 10, 2011 from http://www.agassessment.org/reports/IAASTD/EN/Agriculture%20at%20a%20Crossroads_Executive%20Summary%20of%20the%20Synthesis%20Report%20%28English%29.pdf
- 107 De Schutter, O. (2011, March). Agro-ecology and the right to food. Retrieved September 10, 2011 from http://www.srfood.org/images/stories/pdf/officialreports/20110308_a-hrc-16-49_agroecology_en.pdf
- 108 Wang, S., Just, D.R. and P. Pinstrup-Andersen. Tarnishing Silver Bullets: Bt technology adoption, bounded rationality and the outbreak of secondary pest infestations in China. Paper presented at American Ag. Econ. Assoc. annual meeting, Long Beach, CA, 22-26 July, 2006.
- 109 Corpuz, P.G. (2011). Philippines Biotechnology Situation and Outlook. USDA Foreign Agricultural Service, GAIN Report. http://gain.fas.usda.gov/Recent%20GAIN%20Publications/Agricultural%20Biotechnology%20Annual_Manila_Philippines_8-16-2011.pdf
- 110 CRSF (Consumer Rights for Safe Food). (2011, August 5). Position Paper of Consumer Rights for Safe Food on BT Talong. Retrieved August 28, 2011 from <http://no2gmphilippines.wordpress.com/2011/08/05/position-paper-of-consumer-rights-for-safe-food-on-bt-talong/>
- 111 Government of Norway, (2010, April 19) Submission from Norway on the Risks of GMOs to Biodiversity and Human Health. Retrieved September 2, 2011 from <http://www.gmwatch.org/latest-listing/1-news-items/12148-submission-from-norway-on-risks-of-gmos>



Pesticide Action Network Asia and the Pacific (PAN AP) is one of five regional centres of PAN, a global network which aims to eliminate the harm caused by pesticides and promote biodiversity-based ecological agriculture. It is committed to the empowerment of people especially women, agricultural workers, peasants and indigenous farmers. PAN AP launched its Save Our Rice Campaign in 2003

in response to the powerful threats arising against rice, the staple food of half the world's population. The foundation of the Campaign is the "Five Pillars of Rice Wisdom": (1) Rice Culture, (2) Community Wisdom, (3) Biodiversity-based Ecological Agriculture, (4) Safe Food and (5) Food Sovereignty. The Campaign is dedicated to saving traditional local rice, small rice farmers, rice lands and the rice heritage of Asia. PAN AP Rice Sheets provide relevant information on the threats to rice and are written from the people's perspective. Enquiries may be sent to: panap@panap.net

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