ASSOCIATION FOR ADVANCEMENT IN PLANT PROTECTION

Newsletter

2006

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Together we will protect our crops

Inside this issue

CM launches aapp Newsletter

At the inaugural of Eastern Regional Agricultural Fair-2006

The Eastern Regional Agricultural Fair-2006 was organised at the Bidhan Chandra Krishi Viswavidyalaya campus sponsored by the Directorate of Extension, Ministry of Agriculture & Cooperation, GOI and Department of Agriculture, Govt. of West Bengal.The Fair was inaugurated by the Hon'ble Buddhadeb Bhattacharya, Chief Minister of Govt. of West Bengal on 30th January, 2005. The fair had a significant participation from the States of Bihar, Jharkhand, Orissa and Assam. The Fair continued for 3 days and other than thousands of participants and visitors from W. Bengal, more than 150 representatives from other participating states enriched the Fair and its multifarious agriculture-oriented programmes.These included Scientists-Farmer interaction, crop competition in relation to vegetables, flowers, fruits and agro-based handicraft articles, quiz competition, display of technological options through stalls and received enthusiastic participation each day. Nearly 188 women participated vigorously in the Women Empowerment Programme.

The Chief Minister, Mr. Bhattacharya in his inaugural speech focussed on the agrarian revolution in W. Bengal that is underway particularly during the last decade, be it in cultivation of cereals, vegetable, fruits or flowers as global markets open up. He also focussed on the need for more extensive and intensive researches in protecting the produce while in the field, after harvest, in transit and during marketing, not just through cold chains but through other alternative, cheaper, meaningful technologies of protection, given the support available through information technology, biotechnology and other microbial technologies. Having declared the Fair open, the Chief Minister then launched the mascot of the Association for Advancement in Plant protection,*The Newsletter*, handed over to him by the Secretary,Prof. Shantanu Jha. He expressed hope that such efforts will further strengthen the agrarian revolution already underway. The Newsletter was distributed among the dignitaries and received appreciation on its quality and content.

Whither Higher Education?[1]

Satyabrata Maiti, Director, National Research Center for Medicinal and Aromatic Plants, Boriavi 387 310, Anand, Gujarat, (satyabratamaiti@hotmail.com).

I read with great interest the views expressed by Dr. C. Chattopadhyay about "Human resources for plant pathology in India: what's bakin', what's cookin" ??. The author has pointed to the problem of fast deterioration in quality of knowledge among the plant protection personnel of recent years and also tried to correlate these issues with the mediocrity in teaching and research. The point to ponder is whether this is a localised problem restricted to plant protection that can be restored by a simple 'Hey! Tighten your belts and react'.Thinking about this brought some more awesome and sobering thoughts of a malaise that is scourging the very fabric of our society today and that needs to be addressed urgently at all levels.

As the 21st century began its march,environmental concerns have become of paramount importance not only in physical sense but also in all fields that encompasses us such as family, institutional, social, and political, etc. In the recent past we faced a whole series of global problems. What Dr. Chattopadhyay expressed is not a matter of concern with plant protection alone. But it is a general problem of our present education system. The more we study the major problems of our time, the more we come to realize that if we want to understand why it is so, we cannot get the answer, if we stand alone in isolation.These are systemic problems and are interconnected and interdependent with all facets of our lives and society. For example quality education in plant protection is possible if quality teachers are available in the universities and to get quality teachers, we should have quality students in the universities. Quality students in the university come from quality schools. Quality schools are built in a quality civic society. If we go further and deeper down, we will find that improvement in quality of our life style is possible when poverty is reduced worldwide.

Our society is now fast transforming from its state of spiritual satisfaction to material hunger due to consumerism and globalisation. Political instability and blurred focus, are also adding to the whole process of deterioration in our quality life. ***Protectionism by way of reservation in education is also adding to it.*** The question that needs resolution is how to reverse the process of rotting so that we can get back to our past glory of quality life in all fields of our activities and can stand as a nation united. If we can do that,our plant protection also will reach to its top glory following the same path.

This would be possible if we can all do our best without favouring any one in the academic field on the basis of caste, creed, political affiliation, etc. I am happy that Dr. Chattopadhyay invited the readers for soul-searching. I am sure if we do so every evening, we shall be doing immense service to turn around the situation. Let's realise the problem and let us try to change our micro-environment, which will collectively change our macro-environment. Good luck to all the readers. I look forward with optimism!

1 The editors solicit comments,opinions for or against a concept muted by the author.They will be published in the next issue.

Stripping the blast path

Magnaporthe grisea, the filamentous ascomycetous fungus causing blast of rice, estimated to destroy food of up to 60 million people per annum, encodes 11,109 predicted proteins from draft 37.8 Mb genome that is more than any other non-pathogenic filamentous ascomycetes. The increase in gene number is largely due to an expansion in paralogous gene families and the presence of species-specific genes. *M. grisea* contains a large number of G-protein-coupled receptors (GPCRs), which probably provide the pathogen with greater flexibility to react to changing environments during the infection cycle. These GPCRs include a family of novel GPCR-like genes that contain a fungal-specific extracellular membrane-spanning domain (CFEM) at the N-terminus. The CFEM-GPCRs are absent in non-filamentous ascomycetes and basidiomycetes and are expressed during early infection cycle. The *M. grisea* genome code for enzymes required for breakdown of plant cell wall and cuticle, such as cutinases, not present in a non-pathogenic ascomycete *Neurospora crassa*. This indicates a crucial role for cutinases in pathogenicity of *M. grisea*. The blast pathogen has many genes devoted to secondary metabolism, aiding in its niche exploitation and pathogenicity.The presence of many highly diverse polyketide synthases and their expansion profile during infection process indicate their role in infection. Variability in *M. grisea* is often associated with gene inactivation by natural transposition or deletion of pathogen-associated molecular patterns (PAMP)-encoding genes recognized by the plants' immune components. The repetitive DNA and repeat-induced point mutations within genome were studied to understand the mechanism of variation and genome evolution in *M. grisea*. Many of the host-specificity genes in *M. grisea* are located at transposon-rich regions of the genome, providing increased possibility of host-range expansion by gene inactivation.

[Extracted from: Arnab Pain. 2005. Fungi behaving badly. *Nature Reviews: Microbiology* (Genome Watch) 3: 832-33, ap2@sanger.ac.uk]

Letters to the Editor

Plant protection with cropping systems bias, in my opinion, is virtually another name for sustainable crop husbandry. The current effort at establishing an Association for advancement of this vast integrated discipline, as reflected from the Association's maiden newsletter, seems pregnant with possibilities. The article 'Agroinformatics Action Research for Site Specific Cropping Systems Management' is a voice of times. We, at this University, have fully established the feasibility and usefulness of client-based research and undertake it on demand. Such research can provide basic raw material for feeding the national Agricultural Informatics and Advisory Network System so assiduously conceptualized by Prof. M. K. Dasgupta. Though every word chiseled and fitted into the body of Newsletter appears illuminating for one or other section of plant protection community, Sukumar Chakraborty's 'climate change and disease scenario', Dilip Lakshman's research note on double stranded RNA-RNA mediated hypovirulence of *Rhizoctonia solani* and C. Chattopadhyay's views on 'Human Resources for Plant Pathology in India-what's bakin', what's cookin'??' deserve special mention from researchers and teachers' point of view.

Ram Nayak Singh,
N.D. University of Agriculture & Technology, Faizabad,
U. P., India, (ramnayak_singh@rediffmail.com)

Short Research Notes

Aeginetia pedunculata - a serious parasitic weed on sugarcane in West Bengal

Bikash Ranjan Ray, Sugarcane Research Station, Bethuadahari, 741126, W. B. (brray2@yahoo.co.in),
Mrinal K. Dasgupta (oikos_santiniketan@rediffmail.com)

Sugarcane, grown in the low-lying flood prone areas in the Bhagirathi river banks, within Plassey Sugar Mill command area in Nadia and Murshidabad districts of West Bengal, has regularly been infected by a parasitic angiosperm, *Aeginetia pedunculata* (Roxb.) Wall. (Family Orobanchaceae). A few natural collateral hosts of the parasite were observed such as *Cynodon dactylon*, *Saccharum spontaneum*, *Sorghum bicolor*, *Vetiveria zizanoides*. Although *A. indica* was a serious pest of sugarcane in Japan, Philippines and Taiwan some time back, severe incidence of *A. pedunculata* was never reported from India.

It is a root holoparasite that lacks chlorophyll, root, stem or leaf. Tiny seeds of the parasite (1000 seed weight=12 mg) spread with irrigation or flood water and germinate only with the influence of host root exudates. After germination the tendrils attach themselves with host roots, form tubercles and push into the host roots through haustoria that form a bridge between the vascular systems of the host and the parasite to draw water and nutrients from the host. The parasite gradually

develops an underground scape (rhizome) that gives rise to numerous peduncles which come out of the ground in rainy season and bear flowers during June to December. The sugarcane plant apparently looks healthy but the effects of the vascular wilt as observed in cv BO 91 was severe, and was reflected in the reduction of sucrose content in juice and wilting of the whole clump at maturity.Overall loss of commercial cane sugar was 1.89 t/ha (37 %).

Control measures like hand weeding, post emergence spray of herbicides, crop rotation with rice, sorghum, jute and sesame produced only partial effect. Jute hairy caterpillar was observed as a natural insect herbivore and *Erysiphe cichoracearum* was found as fungal pathogen of *A. pedunculata*. Screening of sugarcane varieties for their resistance to the parasite is in progress. Integrating some of these control measures is also on trial for eradicating this parasite from sugarcane field.

In vitro effects of physical, chemical and biological factors on *Phytophthora palmivora*

B.Srinivasulu, M.V. Lakshmi & K. Aruna, Acharya N. G. Ranga Agricultural University, Agricultural Research Station, Ambajipeta-533 214 (beyyalasri@rediffmail.com).

Phytophthora palmivora Butl. causes bud rot, a lethal disease of coconut. The disease is sporadic in nature and outbreaks of epidemics are also not uncommon. Sporadic incidence of 0.1 to 6.5 in Kerala, 0.4 to 6.7% in Tamil Nadu, 0.9 to 10% in Andhra Pradesh and 35 to 40% in some plantations of Kerala and Karnataka are reported. In Andhra Pradesh, bud rot disease incidence on coconut palms ranged from 1.6% in sandy soils (West Godavari) to 25.0% in black soils (East Godavari) with a grand mean of 13.5% and 4.7% in East Godavari and West Godavari districts, respectively.

P. palmivora was isolated from bud rot diseased crown and nut tissue of coconut and pathogenicity established on coconut leaf tissue and cocoa pods. No significant differences in mycelial growth were recorded in 3 different media over a range of pH and temperature. A moderate sporangia formation was noted over the range oh pH tested (4.0-8.0) whereas no

growth of *P. palmivora* was recorded at pH 7.0 and 8.0 on V8 juice agar media. Light had no influence on papillate sporangia formation. In vitro studies indicated that biocontrol agents viz. *T. viride*, *T. harzianum*, *T. hamatum* and *P. fluorescens* were found to inhibit the mycelial growth of *P. palmivora* to the extent of 82.3%, 75.39%, 71.87% and 69.38% respectively. These are presently being field tested for their potential efficacy .

News : Red Alerts

Coconut eriophyid mite - a recent menace

Coconut, plantations are currently facing a serious threat from a mite pest, *Aceria guerreronis* which till a decade back was not known to exist in W. Bengal. The meristematic zone of the coconuts, covered by the perianth is the site for mite development.They appear externally as whitish triangular patches at the base of the perianth which later turns brown, followed by warting and suberization of the nut epidermis.This leads to drying of young buttons; premature nut dropping; reduction in nut size; and loss in copra yield (20-30%). Yield losses are compounded due to compaction and toughening of the mesocarp (coir) fibres, increasing labour requirements for dehusking.In West Bengal, the first infestation was recorded in North 24-Parganas ten years ago.

A. guerreronis is microscopic; the adults are 35-50µ wide and 200-250µ long. They have a high reproductive rate and a very short life cycle of 10-11 days.

Proper nutritional management with profuse watering is essential to reduce infestation. The following nutrient mixture can be used in two split doses (before and after rainy season): urea-1.3kg/tree/yr, super phosphate-2kg/tree/yr, muriate of potash-3.5 kg/tree/yr, borax 50g/tree/yr, gypsum-1kg/tree/yr, and magnesium sulfate-500 g/tree/yr.

A biopesticide, that may be useful under very limited situations, may be prepared as follows: crush 200g garlic, add some water, sieve through a fine cloth. Dissolve 500g soap in hot water and sieve again. Let the mixture cool, then add 200ml neem oil and mix thoroughly. Now add 10 l water and garlic paste, mix thoroughly. Apply within 4-5 hr. Use of Neem azal T/S 1 % at least one application @3-5 ml/l may also prove to be effective.

The protected habitat of *A. guerreronis* shields it from the effect of the chemicals thus limiting their use in the ongoing control programmes. A 'green' alternative to this is through "Root feeding" with some pesticide mixtures the details of which may be obtained from the source persons.

The acarogenous fungus, *Hirsutella thompsonii* is receiving attention for use as biocontrol agent in some of the Southern states of India.

(**Source**: **A.K.Somchoudhury**, BCKV, Mohanpur (somamarkly@rediffmail.com), **P.K.Sarkar**, BCKV, Kalyani (pijushkly@gmail.com)

Nematodes - a potential threat to pointed gourd (*parwal*) cultivation in W. Bengal

Pointed gourd (commonly known as *parwal*) growers in West Bengal are facing a persistent problem of crop failure particularly in vegetable-vegetable crop sequences in the areas of light soils of new alluvial region. The farmers in the Chandamari village of Nadia district, W. Bengal showed a fairly significant field problem of pointed gourd where no nematode advisory service was advocated. The infested field depicts the devastating nature of the damage caused by the root galling nematode (*Meloidogyne javanica*) alone or in association with the reniform nematode, *Rotylenchulus reniformis*. The condition of the plants was so poor that no appropriate management practices could be suggested to recover the crop for profitable yield. Individual plant's root system was heavily knotted and atrophied, growth of the vines was badly arrested, leaves appeared yellowing and size reduced and majority of the vines became dry and withered.

Usually, once nematodes appear as a problem in vegetable crops in the cropping sequence, crop rotation with nonhost crops like rice, wheat, maize, mustard, sesame etc. is the most useful practice for reduction of soil nematode population. However, for growing pointed gourd in nematode infested areas, farmers are suggested to determine the pre-plant initial nematode population from the nearest nematode diagnostic centre before growing any vegetables. Sometimes such information can be judged by themselves from their experience of previous crops showing root-knot symptoms in fields. In the nematode infested soils, it is recommended to adopt bare dip treatment of vine cuttings in 500-750ppm carbosulfan for 6hr before planting. After germination of vines, soil application of neem cake at 500 kg/ha as ring application is economical and beneficial. Together with basal application of decomposed FYM at 10 tonnes/ha, pit application of carbofuran at 1kg a.i./ha is also effective. Among the soil antagonists, *Trichoderma viride* 10g/pit or *Paecilomyces lilacinus* 10g/pit (Bionematon) once at planting and second dose 40 days after planting may give better yield.

(**Source**: **Sahidul Mondal**, Farmer, Chandamari, Nadia & **M. R. Khan**, Nematologist, BCKV, mrkhanbckv@rediffmail.com)

Cabinet approval for establishment of Global Crop Diversity Trust

On Jan. 12, 2006, the Union Cabinet gave its approval for signing the agreement for establishment of the *Global Crop Diversity Trust* under Article 18 of the International Treaty on Plant Genetic Resources for Food & Agriculture (ITPGRFA) for making a one time voluntary contribution of US $ 50,000 to the Global Crop Diversity Trust towards sustainable use of plant genetic resources for food and agriculture. It is in harmony with the Convention on Biological Diversity (CBD). The Treaty is of immense importance in ensuring the continued availability of the plant genetic resources that countries will need to feed their people. The Food and Agriculture Organization (FAO) adopted the International Treaty on Plant Genetic Resources for Food and Agriculture in 2001 which came into force in June, 2004.

Global Crop Diversity Trust has been set up as a central element of the funding strategy of the ITPGRFA. Trust will provide support for gene bank conservation and capacity building for developing countries. Trust will function as an autonomous international trust charged with providing effective and efficient support to the long-term ex-situ conservation of Crop Diversity. It will support the implementation of the Global Plan of Action for the Conservation and Sustainable Utilization of Plant Genetic Resources for Food & Agriculture. Trust will conserve the crop diversity that supports the major food crops for the poor all over the world.

(**Source**: Internet)

Winemakers toast biotech benefits

Winemaking is steeped in history and tradition perhaps more than any other food or beverage industry. From the soil and climate, to the grapes and their harvest, to the crushing and aging processes, painstaking attention to detail dictates the flavour, bouquet and overall sensory experience of the final product. So it may surprise you to learn that the industry is increasingly looking to biotechnology for opportunities to combat crop diseases, lower production costs, produce healthier and more flavourful products, and boost bottom lines.

(**Source**: Council of Biotechnology Information)

Pesticide Warning : A study conducted by the Centre for Science & Environment has found shockingly high levels of pesticides residues in human blood samples taken from Punjab villages.
(**Source**: Deccan Herald, India, June 2005)

Nematodes - a pest of crops and tool for biocontrol of insect-pest

Nematode is an important pathogen of crops but a few nematode groups are also associated with herbivore insect pests. Plant nematologists are confronting with the difficulties in managing this hidden but tiny pest. Some efforts are being made to explore alternatives to use of chemical nematicides. Success with crop rotation, nematode tolerant varieties, incorporation of organics, intercropping, nematode suppressive bioagents are giving limited succour. Beneficial insect parasitic nematodes are commonly known as Entomopathogenic nematode (EPN) and belong to the genera *Steinernema* and *Heterorhabditis*. Both the nematodes carry a symbiotic bacterium. *Xenorhabdus nematophilus,* is the symbiont of *Steinernema* and *Photorhabdus luminescens* that of *Heterorhabditis*. The insects are usually attacked at immature stages. The mortality of insect occurs with 24-48hr due to the action of the associated bacterium. EPNs are most effective bioagents, being effective mostly against the lepidopteran and coleopteran insects damaging in cryptic conditions. Some pioneering work on exploration of improved indigenous strains of EPN have been done at PDBC, Bangalore, India. Recently, a National Workshop was organized during 21-22, November, 2005 by a Chennai based Sun Agro Biotech Research Centre where more than thirty research scientists mainly from ICAR Institutes and SAUs were assembled to discuss ways and means of promotion and commercialization of promising bioagents. In this forum, eminent scientists, Prof. T. N. Ananthakrishnan, K. V. Peter (Vice-Chancellor, Kerala Agricultural University), Dr. R. J. Rabindra (Director, PDBC, Bangalore) were present and enlightened the Workshop participants with their valuable thoughts on various aspects like promotion of green technology, development of industry-research partnership, mass production of EPN and other bioagents for management of nematodes and insect pests of crops.

(Source : M.R. Ghosh & M.R. Khan)

New *Trichoderma* based biopesticide launched

Gujarat Green Revolution Company Limited (GGRC), Vadodara, Gujarat has launched a biofungicide based on *Trichoderma harzianum* (Strain No. NBRI 1055) on 27th March 2006. The product is commercialized as *SARDAR ECOGREEN* and is claimed to have several properties that include antifungal, antinematode, plant growth promoting, and induction of systemic resistance, compost decomposition and phosphate solubilization properties. It is claimed to be effective against collar rot, white rot and blight, root rot and web blight, wilt, foot rot, red rot and damping off by pathogens. GGRC will also launch the biofungicide in seven states of the country very shortly.

(**Source**:H.B. Singh, NBRI, Lucknow, hbs1@rediffmail.com)

Stop imports of fruits, vegetables & the why of it

The Confederation of Indian Farmers' Alliance (CIFA), Kolkata has urged the Union Government on 31st March, 2006 to stop import of fresh fruits and vegetables until it becomes possible to establish necessary infrastructure in the country's ports and airports for pesticides residue monitoring.

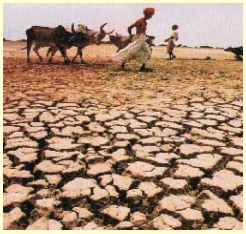
Welcoming the recent agri-technology agreement with the US, the Confederation has also cautioned against the new pesticides and chemicals used for preserving these products in the US and other countries. Chengal Reddy, Secretary General, CIFA, told Business Line that the Government should tell importers to ensure declaration of all the new pesticide molecules used by American farmers on and off-the-field (including preservatives) and "necessary approvals must be sought and obtained prior to exports to India".

According to the association, the new pesticides and chemicals used thereon were neither registered in India nor have they been approved by the Government regulatory authorities. Reddy said: "It is necessary, and in fact obligatory, on the part of the Indian Government to create a level-playing field in the era of WTO for Indian agriculture to sustain itself and survive". He said when agri commodities were exported, they were subjected to strict SPS (Sanitary and Phytosanitary) checks, but when fresh fruits and vegetables were imported into India, they were not subjected to residue analysis. Strict SPS measures has begun to strangulate agri exports.

News from the World

Improved drought tolerance in plants: vitamin C provides link to plant's abilty to withstand drought

Researchers at the University of California, Riverside have found yet another way to improve a crop's ability to survive drought, raising hope that more food can be grown in arid regions of the developing world. This discovery will assist farmers who depend on rainwater for their crops during those years when rainfall is low ... and should help farmers who grow crops in arid areas such as exists in many third-world countries. Gallie and biochemistry Professor Zhong Chen have discovered that reducing a tobacco plant's ability to recycle vitamin C causes it to scale back the amount of water that escapes from its leaves. That, in turn, allows the plant to better survive drought conditions.



In 2002, researchers at Cornell University in New York used a different scientific approach to develop hardier biotech rice that can resist drought and thrive in marginal soil. Here, the researchers took the genes that synthesize trehalose,a simple sugar that is produced in a wide variety of plants, including the resurrection plant and inserted them into rice. The resurrection plant is a desert moss that can slow its activity to zero during a drought and completely revive with the return of water.

The ability to conserve water is becoming increasingly important particularly in Asia where demand for more and better food is taxing natural resources. With global warming comes increasing examples of unstable weather patterns worldwide. Regions that once experienced normal rainfall such as parts of Central India as well as California are becoming semi-arid due to warming occurring during the past two decades, according to the U.S. Environmental Protection Agency.

As global warming continues to play havoc with our weather patterns, some areas might receive less rain, some may receive more rain. This research can address unpredictable periods of drought caused by global warming. Increasing drought tolerance in crops is highly valuable to the world agriculture now, and will be even more critical as our environment continues to change as a consequence of global warming conditions.

(**Source :** Internet)

Beware (Be aware) of what you eat

In recent years, "you are what you eat" has become a popular adage, a truism, perhaps a bit of a cliché. The new technology of genetic engineering (GE), coupled with an unprecedented concentration of corporate control over the processing and distribution of foodâ€"and especially the sources of our seedsâ€"has cast doubt on the safety and integrity of even some of the most common foods we eat every day. Recently, through a trilogy of documentaries, the threats posed by hurried release of genetically modified organisms (GMOs) without having adequate safeguards in place, has been highlighted.

Scene 1: In the sprawling prairies of Saskatchewan, Canada countless farms were saved in the mid-1990s by converting to growing organic canola. But an invasion of genetically engineered canola, developed by Monsanto to withstand applications of their Roundup-brand weed killers, ultimately reversed this progress. Pollen from GE canola spread for miles and seeds blew freely from farm to farm; the survival of countless organic and even conventional non-GE farms was threatened.

Scene 2: In Hyderabad, Andhra Pradesh in central India, where local cotton growers have organised to resist the introduction of genetically engineered cottonâ€"in this case engineered to increased tolerance to a pesticide that aims to kill the cotton bollworm, a persistent and damaging pest. Following a hyper-aggressive marketing campaign, featuring give-aways and flashy, Bollywood-style TV ads, numerous farmers in India came to believe that the new "Bt cotton" was the answer to their problems, and they mortgaged their farms and their futures to embrace the new technology. But the bollworm resistance failed and crop yields fell dramatically, forcing many to sell their land.Thousands of farmers

committed suicide so their families could escape the burden of mounting debts. Now, whole communities are organizing to vent their rage toward local representatives of multinational seed companies.

Scene 3: Indian physicist, author and activist Dr. Vandana Shiva offers a tour of one of the most inspiring places in the world for people who care about food: the *Navdanya* seed farm in the Himalayan foothills. There one views some varieties of traditional rice, beans, and peas that have been preserved through *Navdanya's* efforts. We are reminded that healthy diets depend on healthy, loving relations to the land, both for our farmers and ourselves.

"[This] is a technology that can not exist with nature; it is a technology that invades, pollutes, contaminates, and ultimately destroys the natural species," explains attorney Andrew Kimbrell of the Center for Food Safety, one of the most persistent GMO opponents in the US. For those of us who are more cautious, it is unclear whether the hazards indicated has a direct link to genetic engineering, as GMOs had only begun to be introduced into commercial agriculture a few years back.

(**Source**: Brian Tokar, Development, Environment and Value (DEV) Bulletin, Vol. 2, Issue 42 , March 31, 2006.)

Mutation in a single gene switches a fungus-grass symbiosis from mutualistic to antagonistic

Fungal endophytes in the genus *Epichloë* form symbiotic associations with many grasses. Studies have shown that *Epichloë* endophytes can result in enhanced biomass production, seed production, and root growth of the grass plants as well as improved recovery after drought compared to plants without endophytes. Like other endophytes, the symbioses of grass species with *Epichloë* fungi can be mutualistic or antagonistic or both.

Aiko Tanaka *et al.* discovered a novel role for reactive oxygen species (ROS) in regulating the mutualistic interaction between *E. festucae* and its grass host. They used a forward genetics approach to create mutants of the endophyte that would be unable to establish or maintain a mutualistic relationship with perennial ryegrass. They isolated a mutant that is unable to synchronize its growth with that of the plant host. Plants infected with the mutant fungus showed stunted growth, premature senescence, and death. This was accompanied by a dramatic increase in fungal endophyte growth within the plant compared with plants inoculated with wild-type fungus.

Thus a mutualistic interaction became an antagonistic one with the mutation of a single gene. They determined that the foreign DNA had disrupted a fungal gene, called noxA, which encodes an enzyme that catalyzes the conversion of molecular oxygen to superoxide. Superoxides are unstable and highly reactive molecules that can be extremely destructive in biological systems and have been implicated, for example, as causal agents in cancer formation

This study has highlighted a previously unknown role for ROS in maintaining a mutualistic symbiosis between endophytic fungi and plants and shown that the mutation of the fungal noxA gene can switch the symbiosis from beneficial to antagonistic. The ROS act as a brake on the growth of the fungus, preventing it from becoming pathogenic and allowing it to maintain a beneficial, mutualistic symbiosis with the plant. When this gene is disrupted, the growth of the fungus is uncontrolled and the association becomes pathogenic.

Can this molecular understanding provide a novel tool for managing pathogenic root associations?

(**Source**: American Society of Plant Biologist - Development, Environment and Value (DEV) Bulletin,Vol. 2, Issue 41, March 31, 2006)

Pheromones in bark beetles provides management potential through gene manipulation

University of Nevada, scientists have ended a decade-long controversy over the process by which bark beetles make pheromones: they manufacture their own monoterpenes the fragrant substances plants produce and which are often used in perfumes. It had been thought that insects and other animals were incapable of making these substances. Bark beetles plague pine forests, especially when the trees are stressed. The Lake Tahoe basin lost 30 percent of its pines to bark beetle infestation during the 1986-1994 drought, according to Blomquist.

There are several hundred species of bark beetles, which are in the insect family Scolytidae. These beetles are difficult to control via insecticides because they live almost all of their lives, from eggs to adults, burrowed under thick bark where they are protected. Only for a few hours do they fly from one tree to another to join other bark beetles, mate and start a new life cycle.

But other bark beetles know where to locate mates because they are responding to an "aggregation" pheromone. If this pheromone could be disrupted, the beetles wouldn't be able to organize a "mass attack" to successfully colonize a tree, and they would die.

University of Nevada, Reno researchers have characterized the key gene in the beetle's monoterpene biosynthesis, which will allow further research into ways to disrupt the production of aggregation pheromone and thus minimize beetle damage to forest trees.

(**Source** : Biology News Net) .

On sustainability of natural resources: nature-man contract

Plants and animals help maintain fully the process of circulation by returning to the Nature the resources they take from Nature. But there is trouble with man. Man has created between himself and Nature another world, which interferes with the give-and-take and mutual reaction between Nature and himself. But he should not forget also that he cannot survive for long if he ignores the basic truth that the sustenance of his own vitality depends on the sustenance of vitality of land.

(**Source**: *The Robbery of Soil,* Rabindranath Tagore, included in *The Poet and Ploughman* by Leonard Knight Elmhirst)

From the Editor's Desk

Physics has long been considered as the mother of all sciences that will provide one day a final theory,'Theory of Everything'. In other words, this theory (law?) would explain simplistically everything that occurs on this earth through a mathematical equation arrived at by a process of simplification in finding that 'driving force' (it is realized that occurrence of every event/reaction was guided by one or other of the four forces of nature: gravitational, electromagnetic, weak and strong force). Understanding this driving force through physical laws led to several paradigm shifts and a hypothesis that everything is governed by one or more of these four forces. Can these four forces be unified through a single formula that will explain every event on this planet? Everything? Possibly not. Matters of mind and conscience are possibly beyond physical laws. While the Cartesian mechanism emphasized on measurements and their quantification, Rene Descartes created the method of analytical thinking which consists in breaking up complex phenomenon into pieces to understand the behaviour of the whole from the properties of its parts, be it living or non-living. Stephen Hawking, who expected the theory to be propounded by the end of 20th century stated in his book, A *Brief History of Time,* that theory of everything, once discovered, will explain God's mind. In 1997, he still believed we shall have a theory of everything in about 20 years time while shifting from the theory of black hole to string theory of increasing forces along the bead, but at last conceded (2005) that perhaps not every thing can be explained through a final simplistic theory.

The matter of mind brings us back to the question raised by Austrian Physicist, Erwin Schrödinger, 'What is life?', That perhaps provided the first hypothesis about the molecular structure of genes. During the next several decades this new field, molecular biology, underwent several paradigm shifts, leading to the unraveling of the genetic code and even sequencing of the entire human genome. Such major breakthroughs still failed to answer the original question and the associated questions like how did complex structures evolve out of a collection of molecules. What is the relationship between mind and brain? What is consciousness? In other words, we have as yet no answer to the understanding of vital integrative actions of living organisms. After over a quarter century of frantic research we almost came a full circle and answer to the original question still eluded us. May be the answer lies beyond the realm of either *p*hysics or molecular biology (Judson, 1779,The *Eighth Day of Creation)*. The next decade saw the emergence of understanding complex, highly integrative systems of life given different names viz. 'dynamic systems theory', 'the theory of complexity', 'nonlinear dynamics' and 'network dynamics' and so on. The key concepts included chaotic fractals, dissipative structures, self organization and autopoietic networks, glimpses of which are available in '*The Web of Life*' by physicist Fritzof Capra, wherein he proposes and explains the change of paradigm from a mechanistic to an ecological world view. Back again on a physicist's drawing board? Possibly not. This new paradigm of a holistic worldview of seeing the world as an integrated whole rather than dissociated collection of parts, underlies the concept of an ecological view.

In this view, the connection in the changes between thinking and values are seen as shifts from self assertion to integration, both essential aspects of all living systems. Again, ecological perceptions of the world and corresponding behavior is not logical but a psychological one which suggests that in taking care of ourselves, we need to care for all components of the living nature.

In plant protection parlance, therefore it becomes imperative and immanent that we take care of the parasites/stressors in taking care of our own crop plants, if we indeed want to be sustainable!

Chitreshwar Sen
Editor-in-Chief
(On behalf of the Editorial Board)

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