safeguard the public and healthcare workers from the risks arising due to BMW.

The waste handling and collection rules have been circulated amongst the hospitals. BMW should be segregated into specific coloured containers/bags at the point of generation prior to its storage, transportation, treatment and disposal. The containers need to be labelled accordingly. Sontakke stressed that no untreated BMW should be kept/stored beyond a period of 48 h.

Soiled waste, items contaminated with blood and body fluids, including cotton dressing, soiled plaster casts, lines, beddings and other materials contaminated with blood require incineration/autoclave microwaving. Solid waste generated from disposable items such as needles, syringes, scalpels, blades, glass, tubings catheters, intravenous sets, etc. require chemical disinfection autoclave/microwaving and mutilation/shredding to prevent unauthorized reuse.

Liquid waste generated from the laboratory and washing, cleaning housekeeping and disinfecting activities need to be disinfected chemically using 1% hypochlorite solution and discharged into drains. Biomedical research institutes come up with a lot of animal waste, which requires incineration/deep burial. Also cell culture, stocks of specimens of microorganisms and live or attenuated vaccines need autoclaving/microwaving.

According to Sontakke, there are 38 facilities in Maharashtra to dispose BMW safely. To facilitate BMW disposal, the State Government has arranged for transporters, who collect the waste from generators such as hospitals, clinics, dispensaries, pathology laboratories, research institutions, etc. There are incinerators at Taloja, Maharashtra for waste disposal. For detailed information one can visit www.nihfw.org (a website created by the National Institute of Health and Family Welfare) or www.mpcb.mah.nic.in (MPCB).

**Parul R. Sheth** (*S. Ramaseshan Fellow*), E-705/706 Kalp Nagri, Vaishali Nagar, Mulund (West), Mumbai 400 080, India.
e-mail: parulrsheth@gmail.com

MEETING REPORT

# Rice planthoppers strike back*

The rice planthoppers, particularly the brown planthopper (BPH), *Nilaparvata lugens* was once perceived as a threat to rice production in Asia during the mid 1970s. Also labelled as the pest of the green revolution, it had summoned the First International Conference during 1977. Modern high-yielding dwarf rice varieties like Taichung Native 1, IR8 and Jaya had been just then released for commercial cultivation in several Asian countries. Driven by high inputs like nitrogenous fertilizers and irrigation, these varieties offered had a potential to double the yield of the then prevailing long-duration, photosensitive, tall land races and improved selections. Application of high doses of inorganic nitrogenous fertilizers also became inevitable for higher yields. These miracle varieties showed susceptibility to major pests and diseases. Anxious to realize the full potential of these magic varieties, farmers were lured to use broad-spectrum, persistent insecticides like BHC, methyl parathion, etc. Such a practice then led to extensive damage by BPH, termed as hopper burn. In this background, the first international conference was organized at the International Rice Research Institute (IRRI), Philippines. Activities triggered by this meeting, including breeding for BPH resistance and development of IPM packages emphasizing the reduction in unnecessary insecticide use helped keep BPH under control for the next 20 years.

However, during 2005 the planthoppers struck back in southern China in a big way. About 7.53 mha of rice was damaged accounting for 2.77 mt of rice production. During 2006, Vietnam suffered a production loss of 0.4 mt of rice. In a panic response, the Vietnam Government imposed a ban on rice exports, sending shock waves across Southeast Asian countries like Indonesia, Malaysia and the Philippines. This also added to spiralling rise in food price across the globe. This time it is not BPH, but also the two other related species of planthoppers, viz. white backed planthopper (WBPH) *Sogatella furcifera* and the smaller brown planthopper (SBPH), *Laodelahax striatella* that are causing problems. The situation is further compounded with associated transmission of deadly viral diseases like rice ragged stunt, rice grassy stunt and yellowing syndrome of rice. These viruses are transmitted by BPH and SBPH.

With this backdrop, the Second International Conference on Rice Planthoppers was convened by IRRI. The three-day conference brought together 73 participants from 14 countries, who have been involved in research, extension, administration, and production and marketing of seeds and pesticides. The conference critically analysed the causes and consequences of failure of ‘ecological services’ that led to the present crises, reviewed the progress of recent research and identified lacunae. It also debated the action plan at various levels to contain the menace of planthoppers in the immediate future.

In his welcome address, delivered in absentia through a video recording, Robert Zeigler (Director General, IRRI) cautioned that since we had let down our guards on food security during the last 15 years, the world is now facing a crisis in the food front. Peter Kenmore (FAO, Rome) in his keynote address touched upon the science and politics of rice planthopper management in Asia. Being

*A report on the Second International Conference on Rice Planthoppers held at IRRI, Philippines during 23–25 June 2008 and sponsored by FAO, Government of Japan, Thailand and a few Asian countries along with the private sector.

a pioneer researcher, he highlighted the significant role of ecological balance that normally keeps planthopper populations below economic threshold level in a rice field and the havoc that untimely insecticide application brings about by disturbing that balance. He warned that those who forget history are bound to repeat it.

K. Kajisa (IRRI) explained the vicious cycle of food shortage in the 1970s, leading to price rise, crisis, increased investment in research, increased productivity of food crops, rise in food production, fall in food prices, fall in investment in research leading to decrease in productivity gain and back to food shortage.

Jiaan Cheng (Zhejiang University, China) gave an account of the recent outbreaks of planthoppers in Yangtze delta, China. He suggested that increase in area under rice hybrids, early migration of planthoppers from Vietnam, increased use of neonicotinoid insecticides for pest control and rising minimum temperature could have created outbreaks of BPH, WBPH and SBPH in China. Resistance in the new class of insecticides is also reported from this area.

Tomanari Watanabe (National Agriculture Research Centre (NARC), Tsukuba, Japan) gave a detailed account of long-distance migration of planthoppers from China and Vietnam to the southern parts of Japan, and factors causing such outbreaks. Long-winged forms of adults take to wings during dusk and move along the low-level jet stream of air that prevails during May–June. He also mentioned that these migratory insects already have high level of resistance against insecticides like imidacloprid (in BPH) and fipronil (in WBPH).

Current status of insecticide resistance in rice planthoppers in Asia was presented by M. Matsumara (NARC, Kumamoto, Japan). Populations of BPH in China, Japan, Taiwan and Vietnam registered 40–120 fold resistance to imidacloprid, while populations of WBPH recorded similar levels of resistance against fipronil. Extreme level of 800 fold resistance is noted in Mekong delta southern Vietnam. Pepiito Cabauaton (IRRI) explained about rice viruses transmitted by BPH. Symptoms of infection by Rice Ragged Stunt Virus (RPSV) and Rice Grassy Stunt Virus (RGSV) differed based on single and combined infections. Strain 2 of RGSV is more virulent and severe. A combined infection of RRSV, RGSV and Rice Tungro Spherical Virus causes severe stunting of the plant and even death. He opined that RRSV and RGSV are basically insect viruses acquiring virulence against rice plant.

Aktia Otuka (NARC, Tsukuba, Japan) explained cross-boundary migrations between the Southeast Asian populations of planthoppers. He suggested possible migrations from the Philippines to Taiwan and southern China. According to him, high WBPH/BPH ratio may have caused low growth rate of BPH in 2006. K. Sogawa (IRRI) explained the studies conducted in China which indicated that rice hybrids were more susceptible to WBPH than the varieties. The WA-CMS line is more susceptible to WBPH than either its restorer or maintainer lines. This has led to outbreaks in China in 1987 and 1991. The *japonica* rice, Chenjiang 06 (CJ06) is highly resistant to WBPH, with anti-feeding and ovicidal properties.

Josie Catindig (IRRI) gave an account of the planthoppers situation in Asia. While BPH outbreaks were observed in Indonesia during 1977, 1979 and 1986, planthoppers have not been a production constraint since then. More outbreaks of planthoppers in recent years have been recorded in China, affecting 25 mha, of which 0.25 mha in Zhejiang Province was hopper-burned leading to yield loss of 2.27 mt of rice during 2005. In Vietnam, 1.5 and 0.4 mha area of rice was damaged by the planthoppers and the associated virus diseases during 1992 and 2005 respectively. South Korea and Japan have also been affected by recent outbreaks of planthoppers.

Zheng-Rohg Zhu (Zhejiang University) recounted the problem of SBPH and its management. Unlike the other two planthoppers, SBPH feeds on other crops like wheat, barley and rye, and transmits BSDV and RSV diseases. It is also reported to migrate long distances across Vietnam to China. The pest has been noted to have developed high level of resistance to imidacloprid. Delivering the second keynote address, Geoff Gurr (Charles Stuart University, Australia) dealt with the prospects of ecological engineering for planthopper pests of rice. Landscaping for survival and early colonization of beneficial arthropods will improve the performance of natural biological control, he stressed. Use of herbivore-induced plant volatiles to recruit parasites and predators into the planthopper-infested field needs to be tested as an ‘attract and reward’ strategy of IPM.

Darshan Brar (IRRI) summarized the progress of recent research on rice breeding for planthopper resistance. So far, 21 resistance genes for BPH, 8 for WBPH and 14 for the green leafhopper have been identified and some of these have been deployed in elite cultivars of rice. However, planthoppers have shown in the past their ability to evolve virulence quickly against plant resistance. He suggested that marker-assisted selection can help to develop rice varieties with two or more genes pyramided into a single plant. Such pyramids are likely to be durable. Daisuke Fujita (IRRI) gave an account of the recent work identifying *Bph20* and *Bph21* resistance genes from the Indian landrace ADR52. Yolanda Chen (formerly at IRRI) explained the variability in plant–insect interaction at the tri-trophic level. Endoparasites in BPH such as yeast-like symbionts can influence virulence features of the pest.

Hiroaki Noda (National Institute of Agrobiological Science, Japan) dealt in depth about research on the genome of BPH. Now over 31,000 EST sequences from different tissues of the insect have been made available for the public. Also, the DNA from the parasitic bacteria of the pest has been sequenced. He suggested development of different molecular markers for use in studies on pest migration, virulence composition, sex determination, wing polymorphism and insecticide resistance. Bo Seo (National Institute of Crop Science, Korea) explained the mechanism of plant resistance in terms of feeding physiology of the pest.

K. L. Heong (IRRI) discussed the present crisis of frequent outbreaks of planthoppers in some of the East Asian countries in an ecological perspective. He attributed the cause of the problem to the breakdown in ecosystem services. Fourfold increase in pesticide production in China during the last ten years and its export mainly to countries like Vietnam could be the root cause. Frequent and unnecessary use of pesticides resulted in the build-up of resistance in pests and destruction of natural enemies leading to the pest outbreaks. Zhogxian Lu (IRRI) explained the compounding effects of the use of higher doses of nitrogen on pest biology, making the pest more fit to survive and reproduce.

In the final presentation, Nguyen Huan (Ministry of Agriculture & Rural Development, Vietnam) explained the changes in rice farmers’ pest management beliefs and practices in Vietnam. Based on the surveys conducted over the period 1992–2007, he concluded that it is possible to change the perception of farmers towards IPM. Unfortunately, such changes are unsustainable under the external pressures of aggressive marketing tactics of multinational pesticide companies.

The third day of the conference was devoted to brain-storming sessions organized into smaller groups of participants, each addressing one of the issues, viz. research, extension, policy and incentives. Each of the groups enlisted activities under the respective heads, that need to be continued, stopped or initiated to mange the issues. Each group presented their summary recommendations to the convener, which will possibly form the basis for developing a comprehensive action plan document seeking international funding.

**J. S. Bentur*** and **B. C. Viraktamath,** Directorate of Rice Research, Rajendranagar, Hyderabad 500 030, India.
*e-mail: jbentur@yahoo.com

# Prof. Y. T. Thathachari Research Award for Science 2007

The Prof. Y. T. Thathachari Research Award for Science 2007 for Life Sciences and Agricultural Science was shared by K. S. Rangappa, Department of Chemistry, University of Mysore and Desiraju Narasimha Rao, Division of Biological Sciences, Indian Institute of Science, Bangalore. The awards were presented at a function organized by the Bharamara Trust on 26 April 2008 at AIISH Gymkhana, Mysore. Each of the awardees received a cheque for rupees fifty thousand to be used for research, a citation and a memento.

Rangappa has made original contributions in medicinal, bio-organic and physical organic chemistry and has synthesized M1 receptor antagonists and AchE inhibitors for treatment of Alzheimer’s disease. Rangappa’s group has synthesized over 500 bioactive molecules and tested them for their anti-inflammatory (PLA2 inhibitors) and anticancer activities.

Narasimha Rao has worked in DNA–protein interactions. His work provides pathways for research in potential new pharmaceutical applications for treatment of diseases like cancer and Alzhemer’s disease.

At the same function M. S. Valiathan, former President of the Indian National Science Academy was presented the Bharamara’s Life-time Achievement award for his contributions to cardiac diseases and for the development of technology for cardiovascular devices.

# Astronomical sites

In 2005, UNESCO approved the Astronomy and World Heritage Initiative (AWHI) for the recognition, promotion, protection and preservation of places of exceptional cultural value and significance relating to astronomy. AWHI interpreted to include worldwide perceptions of the sky through the ages. The first task is to identify the most exceptional astronomical sites and ‘properties’ that can be included in the world list. At the moment there are no criteria by which the suitability or otherwise, of a site for inclusion in the final list can be determined. The criteria will have to emerge from the long list that we prepare.

UNESCO has recently signed a Memorandum of Understanding with the International Astronomical Union (IAU) to ensure that the two organizations work together in this area. IAU in turn has asked its Commission 41 ‘History of Astronomy’ to do the spadework. I would like to invite suggestions for possible Indian entries. Raja Jai Singh’s Jantar Mantar Observatories in Delhi and Jaipur, St Xavier’s College Observatory, Kolkata and Kodiakanal Observatory are some obvious choices.

It is noteworthy that some sites associated with Struve Arc measurement have already been declared World Heritage Sites. In a similar fashion we can perhaps identify some landmark sites in the Great Trigonometrical Survey of India.

The nominations of astronomical sites through the ages, pertaining to India/Indian sub-continent may kindly be sent to Rajesh Kochhar (e-mail: Rkochhar2000@gmail.com)