

the first super resolution image taken by Betzig using single molecule microscopy<sup>6</sup>.

The methods developed by Betzig, Hell and Moerner have started deciphering whole new levels of understanding of what goes on in the human body down to the nanoscale<sup>1</sup>. Hell has looked inside living nerve cells in order to better understand brain synapses. Moerner has studied proteins involved in Huntington's disease. Betzig has followed cell division inside embryos. These are just a

few examples. Undoubtedly, these exciting discoveries have emerged through painstaking years of research by them and through their intense passion to a century-old problem 'how could Abbe's diffraction limit be circumvented?' This curious and passionate approach to science is an inspiration to all of us.

1. [http://www.nobelprize.org/nobel\\_prizes/chemistry/laureates/2014/](http://www.nobelprize.org/nobel_prizes/chemistry/laureates/2014/)
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3. Klar, T. A., Jakobs, S., Dyba, M., Egner, A. and Hell, S. W., *Proc. Natl. Acad. Sci. USA*, 2000, **97**, 8206–8210.
4. Dickson, R. M., Cubitt, A. B., Tsien, R. Y. and Moerner, W. E., *Nature*, 1997, **388**, 355–358.
5. Betzig, E., *Opt. Lett.*, 1995, **20**, 237–239.
6. Betzig, E. *et al.*, *Science*, 2006, **313**, 1642–1645.

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## MEETING REPORT

### Bio-security in agriculture\*

Bio-security in agriculture deals with managing biological risks associated with crop and animal husbandry. As this is an emerging global concern, it necessitates countries to establish bio-security systems, either to meet obligations under international agreements or take advantage of opportunities in trade. Considering the importance of biological risks in agriculture that India faces, a brainstorming session was held recently.

The meeting was chaired by the chief guest K. Satyagopal (National Institute of Plant Health Management (NIPHM), Hyderabad). During the occasion those involved in the management of alien invasive, the eucalyptus gall wasp (*Leptocybe invasa*) were honoured. The success of the eucalyptus wasp management programme stemmed from coordinated efforts of Indian Forest Genetics and Tree Breeding (IFGTB), Coimbatore, ICAR-National Bureau of Agricultural Insect Resources (ICAR-NBAIR), Bengaluru and ITC. N. Bakthavatsalam and A. N. Shylesha (ICAR-NBAIR), John Prashanth Jacob (IFGTB) and H. D. Kulkarni (Indian Paper Manufacturing Association) were honoured for their contributions.

The theme of the meeting was introduced by Abraham Verghese (ICAR-NBAIR). In his opening remarks, the

Guest of Honour, S. N. Sushil (Plant Protection Advisor, New Delhi) highlighted the importance of bio-security in India considering its vast geographical area and vast coast line (7577 km) with 68 notified entry points. He informed that incidence of introduced pests occurs as an initial outbreak followed by continuous chronic damage. Hence, emphasis has to be laid on management, mitigation, forewarning and regulatory mechanisms for invasives. He mentioned the amendments to Destructive Insect Pests Act in respect of invasions and clauses of the Biodiversity Act considering the need for bio-security. He called for a cohesive network comprising State Agricultural universities, ICAR institutes and developmental agencies concerned with plant protection and quarantine to regulate pest invasions and to draw up action plans to contain invasives.

Satyagopal detailed the role of biocontrol agents in suppressing invasives in India, viz. coffee berry borer, potato tuber moth, spiralling whitefly, papaya mealybug, etc. The regulatory policies imposed by the Government, viz. the Biodiversity Act, bio-security analysis, management risks and Sanitary and Phytosanitary Certificate (SPC), 2003 (relating to plant bio-security) were detailed by him. He discussed the drawbacks and omissions in Bio-security Act relating to invasives and importation of natural enemies. He emphasized the need for analysis of looming threats and eradication before establishment, balancing nature and suppression by natural enemies. He

mentioned that improving post-entry quarantine at the panchayat level may aid in creation of awareness. He was of the opinion that ecosystem analysis-based IPM apart from the economic threshold level (ETL)-based IPM was necessary to have better information, understanding and visibility. Capacity building in sanitation and phytosanitation measures were essential to address effectively the issues related to bio-security.

The technical session on issues related to insect taxonomic research was chaired by C. A. Viraktamath (UAS, GKVK, Bengaluru). J. Poorani (ICAR-NBAIR) delivered a talk on 'Legislative obstacles to insect taxonomic research – a potential threat to India's bio-security'. The relation between taxonomy and bio-security was discussed. With a wide geographical spread and biodiversity, only one-third of the insects in the country have been documented. The drawback is mainly due to shortage of manpower to carry out taxonomy related work and only 35% of the area in taxonomic research in India is addressed by the Zoological Society of India (ZSI). Identification services can be done at best, if taxonomists are permitted to exchange specimens at the international level. To overcome the hurdle in exchange of dead specimens between taxonomists of our country and experts from abroad, the guidelines of the Biodiversity Act have to be suitably modified to enable the exchange of specimens between repositories. Poorani also highlighted the existing gaps in the Biodiversity Act and guidelines that are difficult

\*A report on a brainstorming session on 'Bio-security issues in relation to insects and quarantine' held on 26 August 2014 at ICAR-National Bureau of Agricultural Insect Resources, Bengaluru.

to enforce. The implications of molecular taxonomy vis-a-vis morphological identifications were brought out.

A. N. Shylesha (ICAR-NBAIR) presented an overview of invasive insects and potential threats. He mentioned the impact of invasives, recent introductions, their routes of invasion and measures taken to contain damage caused by them. M. Krishna Reddy (ICAR–Indian Institute of Horticultural Research, Bengaluru) highlighted the invasive diseases, quarantine and impact of climate change on alien invasive diseases. Considering the importance of trade, he stressed the need to strengthen pest risk analysis for quarantine pests and invasives. Intensifying efforts to develop diagnostic techniques will be of immense value during surveillance and it would aid in monitoring the entry and spread of invasives. He opined that capacity building and networking by linking quarantine systems must coexist to contain the ill-effects of invasive diseases.

The need for domestic quarantine and management strategies for invasives was emphasized by Rajan (ICAR). He opined that details on extent of damage, preventive measures taken and success obtained in management of invasives are to be documented. He also suggested that the population map of invasives in the country be prepared. Replying to this, Shylesha mentioned that the initial observation of invasions are localized and therefore at a low profile. He endorsed the need to monitor the spread and develop action plans to contain them and prevent their spread.

Reacting to the deliberations, Virak-tamath was of the opinion that authenti-

cation of reports on invasives must be in place prior to reporting, as misreporting does more damage to the country's trade and farming community. Reporting of new pest species is to be done with care and their identity is to be confirmed by taxonomists prior to reporting or taking up further work on the management of the pest. This can be operationalized when State Agricultural Universities, ICAR and quarantine authorities work in tandem. Sushil informed that researchers, students, developmental agencies and the public must be sensitized to the issues related to bio-security and quarantine risks.

The meeting also had attendance from the private sector. Uday Narayan Bhat (Koppert Biosystems) presented the challenges faced in trade of invertebrate biocontrol agents. He highlighted policies that caused delay in executing trade of biocontrol agents. The cumbersome processes involved in getting clearances on regulatory issues for biocontrol agents were flagged. He called upon the authorities to simplify procedures for import of invertebrate biocontrol products. Responding to the issues raised by the private sector, Sushil informed that fast-track clearances cannot be issued for import of bioagents as they have to be examined for safety to non-target organisms, prior to approval for importation. He also suggested that industry can exploit indigenous bioagents for mass multiplication, as this would conserve the biodiversity and safeguard the bio-security of the nation. On the issue related to permission for importing bumble bees, the house felt that the performance of the

species would be suited for temperate regions and that local strains could be exploited for pollination purpose.

The decisions that emerged out of the deliberations as follows: (i) Postgraduate curriculum for entomology to include topics on quarantine and bio-security issues. (ii) Designated repositories to be established in line with international standards. (iii) A national-level database to be commissioned for biocontrol agents. (iv) Forecasting and forewarning of invasive threats to the country to be strengthened. (v) Reports on invasives in the country to be authenticated with taxonomic confirmation. (vi) Taxonomists should form a part of the quarantine facilities at ports of entry to facilitate effective handling of the introductions. (vii) Domestic quarantine to be strengthened and the management strategy for introduced pests to be framed and popularized. (viii) Creation of awareness of invasives in the nine ports. (ix) Researchers, developmental agencies and public to be sensitized to issues related to bio-security. (x) Need to enable free exchange of dead and live insects for research without the intervention of the Biodiversity Act. (xi) Possibility of extending the validity of the import permit for bioagents from six months to two years to be explored.

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## MEETING REPORT

### Way forward for oil palm research and development in India\*

Vegetable oil is the main source of fat for human consumption and is critical for the nutritional security of the human population. However, there is a major deficit in vegetable oil both for edible and industrial purposes in the country.

\*A report of the one day 'National Consultation Meeting on Oil Palm' held on 26 July 2014 at Hyderabad, conducted by Directorate of Oil Palm Research (ICAR), Pedavegi.

India occupies a prominent place in global oilseeds scenario with 12–15% of area for cultivation of oil seeds, 6–7% of vegetable oil production, 9–10% of the total edible oil consumption and 13.6% of vegetable oil import. In spite of having the largest area under oilseeds production in the world (26.77 m ha), the country still imports more than 50% of total vegetable oil requirement at enormous cost. The proportion of import has

increased from a meagre 3% in 1970–71 to almost 56% in 2012–13.

The Oil Palm Area Expansion Programme was implemented in 11 states with moderate results. However, oil palm productivity in various regions was not at the desirable level though very high fresh fruit bunch (FFB) yield of 53.2 tonnes/ha was recorded in a farmer's field in Mysore. An average yield of 20 tonnes/ha was recorded in the coastal districts of Andhra