

## Harnessing desirable insects and managing undesirable insects: way forward in Indian agriculture

The global population was projected to grow to 9.6 billion<sup>1</sup> from 7.1 billion<sup>2</sup> in 2013. India would overtake China to become the most populous country by 2050, adding around 400 million people. Another interesting trend in the pattern of population growth during this period is the phenomenal urban growth. According to UN projections made in 2014, the global urban population would increase to 66% by 2050, from the present 54%. This change would be marked in countries like India, which would add 404 million urban dwellers by 2050 (ref. 3). The larger middle class and elite urban population, and lifestyle changes would stimulate demand for less explored food delicacies and need for farming systems of novel produce. There will also be qualitative changes in the requirement of various food commodities due to differences in food habits and future dietary shifts. India's rural population of 857 million (2014) will shrink by 51.5 million by 2050. Yet, India would still house a larger rural population, and agriculture would remain their mainstay. All the above considerations along with other challenges like climate change, agri-resource poverty, regulations, etc. add further dimensions to the formidable task of achieving and sustaining food and nutritional security of India during the forthcoming decades.

Insects, in agricultural context have many facets, from notorious pests to those farmed for their commercial products. As agricultural crop pests, the present losses due to insect pest damages are estimated at 17.5%, equivalent to a monetary loss of about Rs 2.7 billion<sup>4</sup>. Climate change and other anthropogenic and agricultural systems would trigger qualitative, quantitative, spatial and temporal changes in insect pest populations<sup>5</sup>.

\*A report on the National Entomologists' Meet organized jointly by Society for Advancement of Natural Resins and Gums, ICAR-Indian Institute of Natural Resins and Gums (IINRG) and Network Project on Conservation of Lac Insect Genetic Resources (NP-CLIGR) during 5–7 February 2015 at IINRG, Ranchi.

Pollinators play a significant role in the productivity of a number of crops. Commercial insects that yield products of utility like silk, honey and lac have been shown to be important for livelihood and employment. Insect food farming is a potential segment of agriculture to meet the culinary needs of urban and nutritional requirement of the rural population of the country alike. According to a recent FAO report<sup>6</sup>, at least two billion people include more than 1900 species of insects in their food; the beetles are the most common insects. Insects are sometimes the only source of essential proteins (amino acids), fats, vitamins and minerals for forest people. In the Central African Republic, 95% of forest people are dependent on eating insects for their protein intake. Edible insects have been part of diet for some ethnic societies, but a general distaste for their consumption is a stumbling block in making them a part of the nutritional basket. As majority of edible insects are gathered from forest habitats, their mass-rearing needs to be explored by merging traditional knowledge and modern science.

In order to appropriately gear the agricultural insect science towards the emerging national scenario, the National Entomologists' was organized. Leading entomologists from different parts of the country and expert domains converged to deliberate on various issues and suggest the right directions. The meeting was attended by 122 delegates from 19 states; 24 lead lectures on key topics were delivered. A compilation of the lead lectures as well as the 52 oral and 110 poster presentations was released during the inaugural session. Nine best oral and eight best posters presentations were awarded. The deliberations centred around seven theme areas encompassing a wide range of entomological aspects, such as current and emerging insect pest challenges and strategies for overcoming them; commercial, beneficial and edible insect farming; habitat architecture, impact of anthropogenic activities on insect dynamics, etc.

R. Ramani (ICAR-Indian Institute of Natural Resins and Gums (IINRG) and

ICAR-Indian Institute of Agricultural Biotechnology) in his welcome address, pointed out that the meeting has provided a platform for convergence of entomologists linked with agriculture. He expressed concern about the dwindling number of entomologists in the National Agricultural Research and Education System (NARES) and the need for significant enhancement of infrastructure for insect science in the era of climate change and other emerging situations. He emphasized on the need for paradigm shift in perception about the role of entomologists in NARES. Ramani desired use of IT for consultations, exchange of information through social network as well as creation of databases on edible insects.

T. P. Rajendran (formerly at ICAR and OSD, National Institute for Biotic Stress Management, Raipur) stressed on the need for cataloguing the edible insect species of the country and developing farming of suitable edible insects. He also sought interventions on the bill on biosecurity and biosafety issues.

N. K. Krishnakumar (ICAR and Chief Guest of the inaugural session) stressed on the population genetics research of pests, chemical ecology, vector entomology, flow of pesticides in the food chain, etc. He emphasized that vector management should form an important component of Integrated Pest Management. He also emphasized on harnessing pollinators for enhancing agricultural productivity. He emphasized on the constitution of local-level task force for pest surveillance and urged for suitable biosecurity measures to restrict inter-state movement of pests/diseases through co-operation of state governments. He pointed out the need for complementation of applied entomological research with relevant basic science. He also called for a national institute for entomological research to address several neglected areas of entomology in the prevailing institutional framework.

George John (Birsra Agricultural University, Ranchi) mentioned that there is a need to identify some potential species which are amenable to farming and take

them forward. He said that insect taxonomists have now moved on to 'endangered' category, which needs to be remedied. He felt that public-private partnership is essential for the development of tasar silk sector.

C. Chattopadhyay (ICAR-National Research Centre for IPM) called for: (i) steps by the government for discouraging indiscriminate use of chemicals, pesticides and measures for filling in the lacunae in the registration of biopesticides and promotion of their use; (ii) IT-supported Integrated Design Support System for surveillance and management of insect pests through Good Agricultural Practices.

R. D. Gautam (IARI) highlighted some insect species of medicinal importance and appealed for documentation of indigenous knowledge and conservation of such species and desired co-ordinated efforts of State and Central Governments to check biopiracy. V. V. Belavady (UAS, Bengaluru) pointed out the impact of monocropping on pollinator diversity. He emphasized on assessment studies as well as conservation of pollinator diversity and numbers with powerful examples of impact of pollinators in crop productivity. S. Sithanandam (Sun Agro

Biotech Research Centre, Chennai) showed the potential of climate stress adapted *Trichogramma* species/strains for biocontrol of moth borers and emphasized on research for imparting insecticide tolerance to such biocontrol agents. Srinivasa Rao (CRIDA, Hyderabad) presented an analysis of the potential impact of climate change on insect pests and different adaptation strategies, and pointed out that we have a long way to go in understanding the pest scenario under climate change. T. V. K. Singh (PJTSAU, Hyderabad) provided insights into the insect resistance to *Bt* crops and underlined the need for in-depth studies to understand the mechanisms. R. K. Gupta (SKUAST Jammu) laid emphasis on Entomophage Insect Park through introduction of suitable plant species for *in situ* establishment of insect enemies of crop pests.

Vasantharaj David made an extensive coverage of various edible insect species in India as well as across the world. He said promotional drives are needed to change the general negative attitude towards inclusion of insects in the diet. In view of changes witnessed in pest scenario, he desired preparation of crop-specific insect pest calendars.

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3. United Nations, Department of Economic and Social Affairs, Population Division, World Urbanization Prospects: The 2014 Revision, Highlights (ST/ESA/SER.A/352), United Nation, New York, 2014, p. 27.
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5. Sharma, H. C., *J. Crop Improv.*, 2014, **28**(2), 229-259.
6. Huis, A. V., Itterbeeck, J. V., Klunder, H., Mertens, E., Halloran, A., Muir, G. and Vantomme, P., FAO Forestry Paper 171, FAO, Rome, 2013, p. 187.

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## MEETING REPORT

### Is solar power cheaper than coal?\*

In the last few years, the cost of grid-connected solar photovoltaic (PV) power has come down drastically. There is strong evidence from international studies that the levelized cost of solar power is on par with coal-fired power plants when the cost of externalities (greenhouse gas emissions, air pollution and ash disposal) is taken into account. A one-day workshop was held recently to explore how far these cost trends of solar and coal-fired power plants are valid in the Indian context. The workshop was

targeted at various players in the power sector, such as decision-makers, bureaucrats, think-tanks, power generation and distribution companies, academic institutes and grass-root organizations.

In his keynote address, Baldev Raj (NIAS) highlighted the importance and challenges of sustainable energy generation in the Indian context. Then, J. Srinivasan (Divecha Centre for Climate Change, IISc) introduced the objectives of the workshop. He highlighted the growth of solar PV technology in recent years; the technology once considered as expensive and impractical has now become promising and viable. In contrast, coal and nuclear technologies which were considered as promising technologies till recently, have become expensive.

Akhilesh Magal (Gujarat Energy Research and Management Institute) gave a

talk on 'A market view on solar PV in India'. He showed that the share of private projects in total installed solar capacity was 34%, with the remaining share coming from state (37%) and national (29%) projects. Solar PV installations have grown from 25 MW in 2011 to 4114 MW in 2015. The market-driven price model adapted in India has translated into record-low solar tariffs; the lowest price bids in 2015 have ranged from 5.05 to 5.25 INR/kWh. Magal concluded his talk with the following comments: "Business as usual" is dangerous for India's power utilities; both utility scale solar and rooftop will revolutionize the way we think of power'.

Sharath Rao (Centre for Study of Science, Technology & Policy) gave a presentation on 'Is the current PV price sustainable?' He showed that the

\*A report on the workshop organized by Divecha Centre for Climate Change, Indian Institute of Science, Bengaluru and National Institute of Advanced Studies (NIAS), Bengaluru on 'Is power generation by solar cheaper than from coal?' on 8 August 2015 at NIAS.