and growth of seedlings besides tissue-specific variation in the occurrence of gall in seedlings were assessed. Variations in the anatomical characters and biochemical parameters were compared to understand the relative resistance/susceptibility among clones and seed sources of eucalyptus to *L. invasa*. Gall development studies showed that the point of oviposition is distinct by few darkly stained sub-epidermal cells. As the egg develops and hatches, the surrounding parenchyma cells intensively divide, and as a consequence the gall protrudes out. In susceptible plants nearby multiple galls diffuse together, whereas in resistant plants isolated galls of maximum two units occur distinctly on the stem.

Stressing the need to develop management strategies against galling in plantation forestry, R. Sundararaj (Institute of Wood Technology, Bangalore) added that large-scale plantation programmes have necessitated a demand for planting stock, for which nurseries have been established in different states. Among the plantation tree species of India, the establishment of teak (*Tectona grandis*) and eucalyptus (*Eucalyptus* spp.) for timber, khejiri (*Prosopis cineraria*) for agro forestry and pongam (*Pongamia pinnata*) for bioenergy plantation often faces problems with a variety of gall inducers, both in nurseries and plantations. In-depth knowledge of galling in these tree species is the key to protecting plantation forests from devastating outbreaks of gall inducers to achieve the goal of plantation forestry.

Highlighting the dynamics of the mango galls, Abraham Verghese opined that among the gall-forming insects on mango leaves, *Procontarinia matteiana* Keiffer & Cocconi (Cecidomyiidae: Diptera) is the most important, occurring in Java, Mauritius and South Africa besides India. *P. matteiana* lay eggs on the ventral surface of the leaves. On hatching the maggots bore into the leaf tissue and feed within, resulting in the formation of circular, biconvex galls on the leaves. The affected leaves get deformed and fall prematurely, which may affect the yield. An attempt was made to find if galls on fallen leaves are related to infestation on the trees, to see whether fallen leaf is an index of gall population on mango trees. This may be a pointer to using fallen leaves as an index of future gall infestation. However, these studies need scaling-up and field testing before they are fully integrated into management.

Chairing the plenary session, Raman stressed the need for more intensive studies of insect galls with an insight into the modalities of gall induction by diverse gallers, so as to be able to appreciate the diversities involved in the process.

T. N. Ananthakrishnan, Flat No. 6, Dwaraka, 22 Kamdar Nagar, 1st Street, Nungambakkam, Chennai 600 034, India;
R. W. Alexander Jesudasan*, Department of Zoology, Madras Christian College (Autonomous), Tambaram East, Chennai 600 059, India.
*e-mail: alexjesu@vsnl.net

MEETING REPORT

Food technology for better nutrition*

Though India is the largest producer of milk and second largest producer of vegetables and fruits, the quantity produced is inadequate to meet the requirements of its population and out of reach of the poor due to lack of purchasing power. A confounding factor is the wastage that occurs due to inadequate and substandard storage facilities, lack of cold storage, and infrastructure for food-processing for value-addition. About 30% of the fruits and vegetables grown in India (40 million tonnes amounting to US$ 13 billion) is estimated to get wasted annually. Wasted food can feed almost 232 million people. Multiplication factor for food processing is 2.4, i.e. for every one rupee wealth created directly, additional 2.4 rupees are earned indirectly through transportation, packaging, cold storage, etc. (D. G. Rao, lecture delivered on World Food Day, Hyderabad, 16 October 2007).

Apart from preventing wastage, generating employment and making food available off-season (which indirectly help in food security), food technology can directly contribute to food security through value-addition to enhance nutrient density. Ready to Cook (RTC), Ready to Heat (RTH) and Ready to Eat (RTE) food help to reduce drudgery. RTE food is popular among all segments of the population.

Against this background, a symposium on food technology for better nutrition was organized in New Delhi. Though the focus was on India, several international experts also participated and provided a global perspective. C. Gopalan (Chairman, Nutrition Foundation of India, New Delhi) welcoming the delegates, highlighted the nutrition challenges in the country and stressed the need for developing affordable technologies that would help improve the nutrition status of the poor, besides meeting the growing demand from the rich for processed food having variety and flavour. He also stressed the need for food-based approaches to combat malnutrition, rather than quick-fix pharmacy-based approaches. V. Prakash (CFTRI, Mysore) said that food technology can also have a societal mission of reaching out to the have-nots. Currently, emphasis is on medium and large-scale industries. There is need for setting up small-scale industries in rural areas where food is produced and where employment is needed.

Food technology can be pre-harvest or post-harvest. The symposium covered both aspects. There were basically three major themes: (a) Technology for improving nutrient content of crops through bio-fortification. (b) Technology for reducing wastage of vegetables and fruits and processing of millets, oils and vegetables. (c) Food fortification to combat micronutrient deficiencies.

The Department of Biotechnology, New Delhi has launched an Indian bio-fortification network project involving more than 15 R&D institutions, with an objective of developing transgenic cultivars of staples like rice, wheat and maize, high in nutrients like iron and zinc that are deficient in the Indian diet. The process involves identification of

*A report of the symposium on 'Food Technology for Better Nutrition' organized by the Nutrition Foundation of India during 30 November–1 December 2007 at the India International Centre, New Delhi.

suitable genotypes which are naturally endowed with high micronutrient density and introgressing them into well-adapted cultivars using marker assisted breeding or genetic engineering. Ajay Parida (MSSRF, Chennai) discussed the progress made in the area. Golden rice, rich in β-carotene (vitamin A) has been developed through genetic engineering and India is testing it. Development of heat and salinity-resistant crops is also being attempted. Global initiatives of Harvest Plus supported by international agencies in developing transgenic crops was discussed by Sherry Tanumilhardjo (University of Wisconsin, Madison, USA). According to Tanumilhardjo, β-carotene-rich sweet potato has given promising results in combating vitamin A deficiency. She also discussed experiments which showed that unlike vitamin A-fortified foods which have the potential of producing hyper-vitaminosis-A due to unregulated absorption and accumulation in the liver, plant food like maize bio-fortified with β-carotene is safe, since there is bio-regulation at the level of absorption and conversion, and toxicity levels are not reached.

Apart from bio-fortification, food fortification has become an accepted method for bridging the micronutrient gap, being most cost-effective if properly implemented. Visith Chavist (Mahidol University, Thailand) discussed the mechanics and dynamics of food fortification. Before launching the programme, the magnitude of deficiency, vehicle to be used, stability of the micronutrient added and several other factors have to be considered. The vehicle for fortification has to be food which the poor eat.

In India, reduction in the incidence of goitre (iodine deficiency disease) through the introduction of idodized salt in the National Goitre Control Programme launched in 1962, is a success story which should have been followed up to its logical conclusion. After the success of this targeted programme, an attempt was made to extend it to the entire country through the National Iodine Deficiency Disease (IDD) Control Programme, in which infrastructure was created for universal iodization of salt and a ban was placed on non-iodized salt. Unfortunately, the ban on non-iodized salt was lifted in 2002, and freight charge for transportation of salt was hiked. The programme faltered and coverage dropped drastically. Some of the ethical issues involved in arbitrary decisions made by the Government and users' right to decide on such crucial health-promotive programmes were discussed by R. Sankar (AIIMS, New Delhi). B. Sesikaran (National Institute of Nutrition, Hyderabad) described successful efforts in not only developing iron-fortified salt, but also iron and iodine double-fortified salt. Both have given promising results in reducing the prevalence of anaemia, and the technology deserves to be translated from production to consumption, to address the dual problem of IDD and anaemia.

Sorghum (jowar), finger millet (ragi), pearl millet (bajra) and other minor millets have been the traditional diet of many communities. They have the dual advantage of being less water-intensive to grow, and more nutritious with higher mineral and vitamin B content. However, in recent years due to a variety of reasons their production and consumption has come down. Efforts are needed to develop RTE convenience foods from millets. Technologies such as blanching, acid treatment, malting, fermentation, dry heating and popping that reduce some anti-nutritional factors and increase the digestibility and shelf-life of millet were presented by K. N. Rai (ICRISAT, Hyderabad).

A successful experiment of reviving forgotten millets in the villages of Uttarakhand to save both the deteriorating ecology and nutrition has been made by the Himalayan Environmental Studies and Conservation Organization (HESCO), Dehradun headed by Anil Joshi. Value-added RTE food like multi-grain biscuits and 'laddus' from millets are not only being used for household consumption, but have become an income-generation activity for women. These are being sold as 'prasad' in important religious shrines like Badrinath, Kedarnath and Vaishnodevi. This experience was presented by Bhavana (HESCO).

The R&D efforts in India, aimed at improving productivity and enhancing the nutritional quality of fruits and vegetables were discussed by G. L. Kaul (Assam Agriculture University, Jorhat) Low productivity and quality, and post-harvest losses due to poor cold chain and infrastructure are the major problems needed to be addressed. Jagdish Singh (Indian Institute of Vegetable Research, Varanasi) spoke about efforts in developing technologies for processing tomatoes.

According to H. N. Mishra (IIT, Kharagpur), food technology at various levels can cater to the nutritional needs of the urban people by making and vending traditional food, which can also generate income. While high-end food technology which has revolutionized access to RTC, RTH and RTE ethnic food was described by Mishra as well as A. S. Bawa (DFRL, Mysore). S. K. Roy (National Horticulture Mission, New Delhi) dwelt on simple primary technologies for rural areas which can prevent wastage of micronutrient-rich fruits and vegetables. M. S. Bamji (Dangoria Charitable Trust, Hyderabad) shared her experience in setting up a rural food-processing-cum-training centre in Narsapur village, Medak District, Andhra Pradesh with the triple objectives of preventing wastage, generating employment and improving nutrition security in villages. Her organization has developed a variety of processed food from local products, some with high nutritional value. Difficulties in marketing, besides erratic power supply and availability of artisans for maintenance of equipment were pointed out to be major constraints in setting up and running small, rural food-processing industries. A good example of public–private cooperation in using food technology for combating malnutrition in children and generating livelihood for rural women in Maharashtra, through the Shri Sathyasai Seva Organization was described by R. D. Shenoy, an independent consultant.

Red palm oil is a rich source of vitamin A. Efforts by Malaysian Palm Oil Industry to develop a stable preparation of red palm oil at affordable cost were presented by Kalandhi Nasarethnam. Apart from β-carotene (vitamin A), palm oil is also rich in tocopherols and tocotrinols, which are powerful antioxidants and metabolic regulators. She described experiments which show anticancer and anti-inflammatory effects of palm oil.

Different types of food technologies used in the World Food Programme (WFP), a massive effort in reaching nutrition to the vulnerable groups, were discussed by Bertrand Sallvignol (WFP, Bangkok).

The symposium provided the state-of-the-art in food processing – a sunrise industry – and provided a road map for the way forward.

Mahtab S. Bamji, Dangoria Charitable Trust, Hyderabad 500 020, India.
e-mail: msbamji@gmail.com