Volume 16 No. 3 July-September 2010

हर कदम, हर डगर
किसानों का हमसफर
भारतीय कृषि अनुसंधान परिषद
Agrisearch with a human touch

भाकृअनुप
ICAR

ICAR NEWS

A SCIENCE AND TECHNOLOGY NEWSLETTER

RESEARCH UPDATE

PROMISING TECHNOLOGIES

Retort pouch technology for shelf-stable meat products

Lack of cold-chains and frequent power failures are major constraints in preservation, distribution and marketing of highly perishable meat products— *curries, gravies, kheema,* soups and meat-balls with limited shelf-life.

Thermal processing of them is known to preserve these food products for a considerably longer time at the room temperature. Initially metal-cans were used for thermally processed foods. But, owing to disadvantages in their use, a new packaging material — retort pouch — was developed for making meat products shelf-stable by the US Army.

A retort-pouch is a flexible, laminated pouch that can withstand thermal processing at a higher temperature. It combines benefits of metal-cans as well as of boil-in-bag. And the laminated material also acts as a barrier to oxygen and moisture.

Flexible, retortable pouches are a unique alternative packaging method for sterile shelf-stable products. Products filled in the pouches are heat-sealed and are sterilized by moist-cooking in a retort to yield commercially sterile foods. Retort-pouch processed foods are microbiologically safe, and have a longer shelf-life at the

Retort-pouched nuggets | Retort-pouched sausages

Indian Council of Agricultural Research
Krishi Bhavan, New Delhi 110 114, India
www.icar.org.in

Retort sterilizer

ambient temperature.

The NRC on Meat has recently added R&D type batch retort with a capacity to process 50 pouches per batch; each of 200 g of ready-to-eat meat products in pouches by thermal processing. The products processed using this technology will have a shelf-life from 6 months to a year at the ambient temperature.

I. Prince Devadason, A.S.R. Anjaneyulu and **Y. Babji**
National Research Centre on Meat
Chengicherla, P.B.No. 19, Uppal P.O.
Hyderabad (Andhra Pradesh) 500 039
e-mail:director@yahoo.co.in

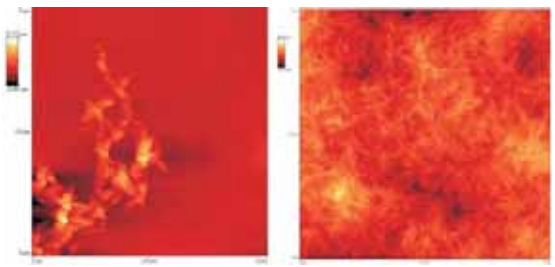
National Agricultural Innovation Project

Nanocellulose from microcrystalline cellulose

A novel pretreatment process for efficient preparation of nanocellulose has been developed, and a 'process patent' has been filed (Patent title: **Zinc chloride pretreatment of microcrystalline cellulose for preparation of nanocellulose by homogenization process)**

Nanocellulose from microcrystalline cellulose has been developed by a homogenization process. Microcrystalline cellulose was prepared from cotton fibres/cotton linters by the traditional hydrochloric-acid hydrolysis process and by treatment with zinc chloride for swelling. After swelling, microcrystalline cellulose was rinsed in water and was subjected to the homogenization process. The untreated cellulose required ten passes to be converted into nanocellulose while zinc chloride pretreated cellulose required only five passes. Average length and thickness of the nanocellulose was less than 500 nm and 50 nm, respectively, as analyzed by the scanning electron microscopy. The yield of the nanocellulose was estimated to be more than 95% from the microcrystalline cellulose.

Atomic Force Microscope Images of Nanocellulose



Nanocellulose by chemo-mechanical process

Nanocellulose by microbial process

N. Vigneshwaran
Central Institute for Research on Cotton Technology
PB No. 16640, Matunga, Mumbai(Maharashtra)400 019

LATEST ADDITIONS

PROCESSING, CHEMISTRY AND APPLICATIONS OF LAC by Bangali Baboo and D.N. Goswani (Price: ₹200; Postage : ₹30)

This book has information on lac processing, chemistry of lac resins,lac dye and wax, physical, spectral and electrical properties of lac,lac applications, future scope of shellac use, besides quality evaluation, standard specifications of lac and lac products.

DAIRY FARMING by Avtar Singh, B.K. Joshi, M.L. Kamboj and Shiv Prasad (Price: ₹200; Postage: ₹30)

It has information on dairy breeds, on their management for optimum productivity and health, on their housing in addition to organic dairy farming and entrepreneurship development in dairy farming.

ORNAMENTAL FISH FARMING by Saroj K. Swain, N. Sarangi and S. Ayyappan(Price: ₹300; Postage: ₹30)

It gives information on the ornamental fishes – commercially important, egg-laying, live-bearing, besides on ornamental fishes breeding protocols, aquarium plants propagation. It also discusses on the possibilities of commercializing ornamental fish farming.

Contact
Business Manager
Telefax: 91-11-25843657; *e-mail:* bmicar@icar.org.in

ICT/ICM initiatives for agricultural R&D

Several ICT-driven information delivery mechanisms have been developed in the ICAR system for quick, effectual and cost-effective message delivery. ICAR institutes' e-connectivity has been strengthened, and a state-of-art data centre is being established to cater to ICT services and to provide connectivity to various stakeholders. A hub has been created at the ICAR headquarters to provide e-linkage to 192 Krishi Vigyan Kendras (KVKs) and 8 Zonal Project Directorates (ZPDs), located across the country. A software has been developed for on-line reporting and monitoring for the management of KVKs and ZPDs. This facility of e-linkage is expected to foster enabling environment for developing close and fruitful partnerships between the subject-matter specialists of the KVKs and the research scientists, extension-workers and farmers.

The ICAR website (www.icar.org.in) has been developed in-house using an open source content management system called Drupal. The website is playing a major role in disseminating knowledge like agro-advisory, press releases, news updates, current events and links to various national/international agricultural organizations/resources through user-friendly interface. The ICAR website's visibility on internet has increased many folds and is attracting more than 142,000 visitors with 43% new visits every month from 139 countries on an average. In continuation to this, now ICAR research journals are also available online, for submitting new manuscripts, reviewing, publishing and downloading articles. This will facilitate our researchers, students and extension workers in reinforcing the fact that ICAR is an apex institution dedicated to quality agricultural growth in India.

Since 2002, **AGRISNET**, a project sponsored by the Ministry of Agriculture, Government of India, is in operation across the country, targeting state/district agricultural and allied departments to provide improved services to the farming communities through ICT.

AGMARKNET, ASHA and **GRC** are some of the major and successful initiatives by the Ministry of Agriculture and Ministry of Communication and Information Technology, Government of India. Some of the other important ICT initiatives in India are: Village Knowledge Center (**VKC**) started by the M.S. Swaminathan Research Foundation (**MSSRF**), **Gyandoot Project** (Dhar District in Madhya Pradesh), **Warna wired village project** (Sangli and Kolhapur districts of Maharashtra), **Ikisan** (Andhra Pradesh), Milk collection centres of dairy cooperative (AMUL, Gujarat), **Tarahaatcom** (Uttar Pradesh) and **Bhoomi** (Karnataka).

Knowledge Help Extension Technology Initiative (KHETI) is for a participatory ICT solution and is experimented with rural poor farmers. In KHETI, with mobiles, one can create Short Dialogue Strips **(SDSs)** using 6 images and 1.5 minutes voices on their queries, problems and other areas of interest. **Agropedia (http:www.agropedia.in)** is another state-of-the-art, one-stop shop for all knowledge, pedagogic or practical, related to Indian agriculture. It has developed 11 knowledge models and uses them for tagging and searching repository objects. These models are universal and can be extended and adopted for any agro-climatic zone. And **e-Granth** has also been launched to strengthen Digital Library and Information Management under the NARS. It is creating Online Public Access Catalogue (OPAC) under the "Indian Agricultural Research Group Catalogue" of all 12 library resources with Online Computer Library Centre (OCLC) partnership, and is digitizing important institutional repositories (IARI, IVRI, ANGRAU and UAS, Bengaluru) including rare books and old journals to make them available in open access. **Bioinformatics** is being explored and utilized for multiple applications in agriculture — generation of powerful databases, designing of user-friendly softwares, managing vast genome sequence data, functional genomics, molecular diagnostics and synthetic biology. A **National Knowledge Network Project** of Government of India has provided link to 9 ICAR institutes/ SAUs, and rest of the institutes will be linked gradually to 100 mbps broadband. Video Conferencing and IP telephony facility has been established at 23 selected ICAR institutes connected on the **ICAR-ERNET** network to facilitate real time communication. A **Consortium for e-Resources in Agriculture (CeRA)** is providing free online access to 2,600 journals from 8 publishers to 126 NARS libraries.

E-courses in B.Sc. (Agricultre), B.V.Sc. & A.H, B.Sc. (Hort.), B.F.Sc. and B.Tech. (Dairy Technology) have been developed. In addition, contents of 56 courses, 2 courses in multimedia and more than 2,000 visual/

animations/videos have been created. **Krishi Prabha,** a repository of digitizing dissertations, ensures their online and offline availability. The ICAR is a designated **National Input Centre for AGRIS** database of the FAO since 1975. Lately, a World-Bank-funded project **Mass Media as Message Multiplier** has also been launched to utilize different modes of communication in an integrated manner for accelerated and sustainable delivery of messages; and showcasing of the ICAR technologies is an important activity of the project. In a total of 23 arranged events, 2,500 farmers/ entrepreneurs could receive first-hand information on the technologies generated. Another unique programme of information delivery for advising farmer is Farmer Mobile Advisory (FMA) with need-based timely information on mobile phones; initiated by the Extension System of the ICAR— under this service every farmer receives messages on Tuesday and Friday. Thus, a farmer will get a total of 104 messages in a year. The FMA is being implemented in 300 KVKs which includes 192 e-linked KVKs. FMA involves major stakeholders of the agriculture development — experts, farmers and extension functionaries/NGO personnel.

Considering importance of knowledge as the critical input in the agricultural research and development, the Government of India has launched several innovative plans cutting across different departments to enhance penetration of internet and mobile-phone connectivity along with the very useful value-added services. Many challenges are still on the way— creation of rural ICT infrastructure, development of appropriate and farmer-friendly content and maintenance of regular flow of information in an interactive mode. Besides, language and climatic variability also are challenge for providing location-specific information for agricultural development. More far-reaching, participatory and ICT driven delivery systems would be evolved in future for effectively linking research with stakeholders.

T. P. Trivedi and **Jagdeep Saxena**
Directorate of Information and Publications of Agriculture, Indian Council of Agricultural Research
Pusa, New Delhi 110 012
e-mail: tptrivedi@icar.org.in

Wheat production doubled in village Nag

Nag, one of the villages of the Takula block in Almora district, was identified under the Wheat Front Line Demonstration (WFD). By the time the WFD was taken up there, most of the farmers had already sown their crop with the traditional variety in the first fortnight of November. Shri Bora, a marginal farmer from this village, and some of the adjacent farmers were planning to sow their fields with the traditional wheat variety. Meanwhile, they had a discussion with the scientists of the institute (VPKAS) about the improved wheat variety VL Gehun 892; suitable for late-sown restricted irrigation conditions; and then they had sown this improved variety on 21 November 2009.

Farmers were assured for buy-back of the produce for seed purpose if they maintained standards of the produce to the desired level of purity and followed other standards. In all, 13 farmers adopted the variety, covering 0.74 hectares. A bullock-operated seed-drill for line-sowing and relevant inputs were also provided as per the WFD norms. They followed recommended seed rate of 125 kg/ha (at 2.5 kg/200 m^2), fertilizers doses of N:P:K:: 120:60:40 and managed weeds by spraying Isoproturon at 1.00 kg/ha. Fields were continuously monitored. VL Gehun 892 yielded 568 ear-heads as compared to 339 ear-heads by the traditional variety per square metre. Farmers could

harvest an average yield of 3.5 tonnes/ha (73.96 kg / 200 m^2), which was double to the traditional variety's yield.

Farmers' participatory seed production improved their skills, besides additional income. *VL Gehun 892 is a micronutrient rich variety too. It contains 35.7, 4.79, 49.8 ppm Zn, Cu and Mn*. With the spread of this variety, nutritional security will also improve.

Lakshmi Kant, Vijay Avinashilingum, N.A., M.L. Roy, A. Gupta and **J.C. Bhatt**
Vivekananda Parvatiya Krishi Anusandhan Sansthan
Almora (Uttarakhand) 263 601

Rare, endemic medicinal plants of Western Ghats

Western Ghats, one of the nine biogeographic regions, have tropical forests— ranging from wet evergreens to dry deciduous ones. And nearly 63% of the tree-species of the evergreen forests of the low and medium elevations of the Ghats are endemic. High level of diversity and endemism has conferred the hot-spot status to the Ghats. It houses many of the important medicinal plants too.

Owing to many natural and unnatural causes, there has been reduction in the number of these species; and many of them have even become extinct. Of the total flowering species, approximately 1,700 are endemic; and out of these, 700 species are being used in the Indian System of Medicine; there is an urgent need to collect and conserve these endemic species.

Four explorations were made during 2007-09; 22 endemic and many rare and endangered species were collected, and have been conserved at the National Gene bank.

Knema attenuata

Uvaria narum

Calamus pseudotenuis

Luvanga eleuthrandra

Veena Gupta, Kavya Dashora and **Meenakshi Bhardwaj**
Division of Germplasm Conservation, National Bureau of Plant Genetic Resources
Pusa Campus, New Delhi110 012

Solanum macrocarpon: Leafy vegetable of Mizoram

Solanum macrocarpon (African eggplant/ nightshade), commonly known as Satinrem in Mizo language, had originated in the wetter parts of the tropical and the subtropical Africa; where wild and cultivated forms occur. In Indonesia and Malaysia, it is being cultivated from the sea level to 600 m; and it has been somehow introduced into north- eastern states of India.

It is a glabrous, erect, branched, herbaceous plant, reaching up to 1.5 m with blackish-violet stem that is woody at the base. Its flowers are complete, actinomorphic, hermaphrodite and perfect. Anthesis occurs at about 5-8 AM. Fruits are light-green when immature and are yellow-brown at maturity.

It is traditionally used as a leafy vegetable by Mizo community. Young leaves are usually cooked and used in curry, meat and soup. Leaves are first harvested after 50-60 days of transplanting. Its fresh leaves have 4.3% proteins, 0.6% fat, 1.4% crude fibres, 1.3% ash and 89.7% moisture. Morphologically and biologically *Solanum macrocarpon* is very close to brinjal (*Solanum melongena*). And this can be used as a genetic resource for improving agronomic traits in brinjal.

B.K. Singh[1], K.A. Pathak[1], Y. Ramakrishna[1], V.K. Verma[2] and **Bidyut C. Deka[2]**
[1]ICAR-RC-NEH Region, Mizoram Centre
Kolasib (Mizoram) 796 081
[2]ICAR-RC-NEH Region, Umroi Road, Barapani
(Meghalaya) 793 103
e-mail: bksinghkushinagar@yahoo.co.in

Lac cultivation on *palas* for income generation

Agriculture is the main source of income for the rainfed Jamtara district of Jharkhand. And the district has also the natural forests of *Butea monosperma (palas)*. *Palas* trees were normally utilized for fuel-wood and other basic requirements. Many farmers have been lately cutting these trees as they were considered of no economical value.

Villagers of Baramajhadih village of Narayanpur block; Dahartola, Charedih, Rupaidih, Sarumundu and Sinjotola of Jamtara block successfully produced and marketed broodlac from the *palas* trees within a year of its introduction. Ten farmers of village Baramajhadih (block Narayanpur) who were earlier not even aware of lac could produce 399 kg broodlac from these trees and earned ₹ 20,000 for the first time. Shri Baladeo Marandi and Shri Nirmal Marandi earned ₹ 7,000 each from summer-season lac-crop, raised during October 2008 and harvested in July 2009. At present, these farmers have formed a FIG named *"Lah Utpadan Samooh, Baramajhadih"*. This group also preserved broodlac (lac-seed) for their own requirement to produce next crop.

Twelve farmers of village Dahartola, Charedih, Rupaidih, Sarumundu and Sinjotola also could produce 354 kg broodlac and earned ₹ 17,700. These farmers have formed FIG named *"Khusiali Lakh Utpadan Samooh, Rupaidih"*. They are able to produce their own broodlac for further propagation; utilizing their own trees.

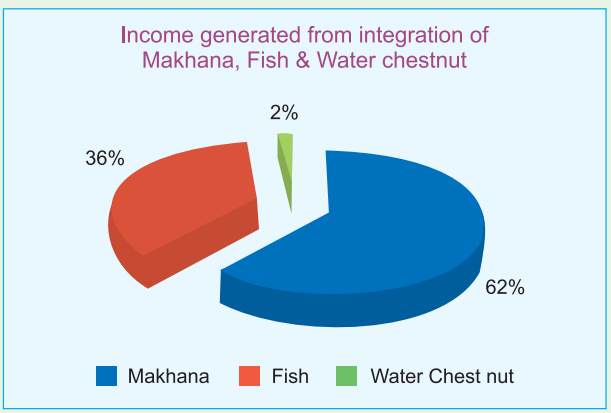
Villagers have stopped cutting naturally available *palas* trees; rather they are preserving them for better environment and exploiting them rationally for income enhancement.

A.P. Srivastava
National Agricultural Innovation Project
e-mail:apsrivastava@icar.org.in

Fish with aquatic crops for employment generation

Fishes were integrated with aquatic commercial crops — *makhana* (*Euryale ferox* Salisb.) and water chestnut (*Trapa bispinosa* Natans) to augment income and generate employment in water-bodies of flood-prone areas of Darbhanga. The technology was demonstrated in 50 hectares with 96 beneficiaries in Darbhanga Sadar Block.

Makhana as the primary crop gave a total net profit of ₹ 790,640 with employment generation of 9,440 man-days per year. The fish as the secondary crop integrated in *makhana* ponds gave additional net income of ₹ 465,680 with employment generation of 890 man- days/year, and water-chestnut as a tertiary crop generated net income of ₹ 25,000 with employment generation of 335 man-days/year.



A.P. Srivastava
National Agricultural Innovation Project
e-mail:apsrivastava@icar.org.in

National Bureau of Agriculturally Important Insects, Bengaluru

Mandate: *To act as a nodal agency for collection, characterization, documentation, conservation, exchange and utilization of agriculturally important insect resources (including mites and spiders) for sustainable agriculture.*

GENESIS AND GROWTH

An All-India Co-ordinated Research Project on Biological Control of Crop Pests and Weeds was initiated in 1977 under the aegis of the Indian Council of Agricultural Research, New Delhi, with the funds from the Department of Science and Technology, Government of India. The ICAR included this project under its research activities with full financial support from 1979 onwards. The Biological Control Centre (BCC) along with the AICRP on BC was initially located at the Indian Institute of Horticultural Research (IIHR), Bengaluru, and was subsequently moved to the premises of the Commonwealth Institute of Biological Control (CIBC), Indian Station, Bengaluru, which was taken over by the ICAR in 1988. The administrative control of the BCC was shifted from the IIHR, Bengaluru, to the National Centre for Integrated Pest Management (NCIPM), Faridabad. Recognising the stellar role played by the biological control in the integrated pest management of crop pests, the BCC was upgraded to a Project Directorate of Biological Control (PDBC) in the VIII plan. This started functioning from 19 October 1993 along with 10-SAU-based and 6-ICAR-based centres of AICRP on BC. In the XI plan, the PDBC was re-oriented into a National Bureau of Agriculturally Important Insects (NBAII) with the AICRP on BC as its component. The NBAII started functioning from 25June 2009 with three divisions — Division of Biosystematics, Biodiversity and Biosafety; Division of Bio-resource Conservation and Utilization and Division of Biotechnology and Bioinformatics.

Location and Facilities. The Bureau along with the main laboratory and the administrative block is located at Bengaluru, on the Bengaluru-Hyderabad National Highway 7, approximately 10 km from the city, close to the Veterinary College. And Research Farm of 10 ha with field, laboratory, nethouse and polyhouse are situated at Attur on Yasavantpur-Yelahanka road.

INFRASTRUCTURE

The bureau has well-equipped laboratories with modern scientific equipments—Walk-in environmental chambers, programmable for temperature, humidity and photoperiod; Image analysis system, complete with software, video-camera, video-playing unit and computer for requisite analysis of data; Gas

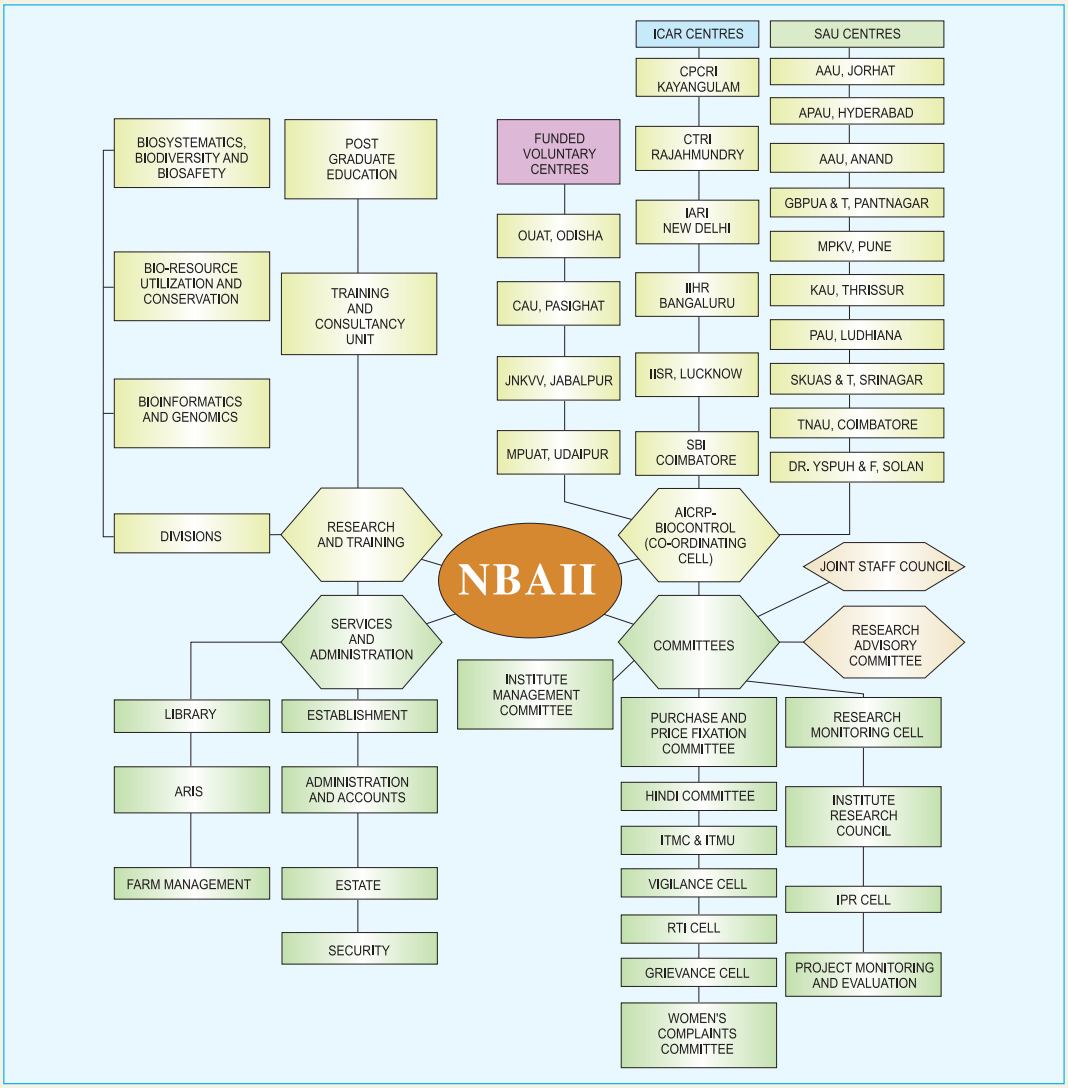
chromatography (GCMS), HPLC, Ultra refrigerated centrifuge; Auto ELISA reader; RTPCR; Fomenters' electrophoresis and electro focussing unit; Inverted phase-contrast microscope with fluorescence; Deep freezer (–85°C); Automatic microtome, leaf area analysis system; Electro antennogram; Insect activity meter; Sun test machine; Optima UV visible spectrophotometer; Thermo forma upright single door freezer; BioCV 16 Lid for bioassay tray, digital camera attachment.

Library. Twelve foreign and 17 Indian journals, mostly of the different areas of biological control, are subscribed; and CD-ROM-abstracts are upgraded from time-to-time.

National Reference Collection. It has 4,225 authentically identified insect species belonging to 235 families under 18 orders. A sizeable reference collection of *Thsanoptera* with 1,000 slides has been added. The information is available in the form of a catalogue, which can be electronically retrieved.

Quarantine Facility. For the first time, a self-contained quarantine facility of the international standards for quarantine of exotic insects and pathogens (for classical biological control of pests) has been created in India.

Research Farm. It has a functional polyhouse and a large nethouse for conducting experiments on the



commercial crops. The Farm has also laboratories for data collection and analysis.

Divisions. *Biosystematics, Biodiversity and Biosafety.* The main activities of this division are collection, characterization and cataloguing of insect resources; biosystematic studies on specified groups of beneficial insects; development of identification tools and databases on insect resources; conducting quarantine and biosafety studies on the introduced insects, and studying effects of climate change on the insect biodiversity.

Quarantine facility

Bio-resource Conservation and Utilization. This division is involved in explorations for specific groups of beneficial insect resources; and basic studies for evolving protocols for mass production of beneficial insects and their utilization and conservation in various agroclimatic situations with special reference to changing climates.

*Biotechnology and Bioinformatics***.** Its activities include developing genomic database and library for insect resources in the country; establishing genetic and molecular evolutionary trends in insects; genetic prospecting of insect resources for maintenance, conservation, utilization and improvement and

Insectory

metagenomic analysis of insect-derived resources. Bioinformatics is involved in modelling spatial patterns in biodiversity of insect resources; development of database, software tools and portals for insect resources; for web consultancy, blogs and e-network for insect resources and workers.

ARIS Cell. This cell has brought out several user-friendly softwares for farmers and researchers—'PDBC INFOBASE' software provides information about bioagents, their use and availability in public and private sectors in the country; 'BIOCOT' provides information about biocontrol measures available for cotton pests; and Expert system 'BIORICE' for biocontrol options for rice pests. 'HELICO-INFO'- a CD has been developed for scientists, researchers, extension-workers, NGO's and farmers for informing about *Helicoverpa armigera* and its natural enemies.

Research Monitoring, Evaluation and Training and Documentation Cell. The cell has the mandate of monitoring , evaluating various institute's and laterally funded projects, besides providing training on the mass production of quality biocontrol agents, including biopesticides.

Insectory – inside view

ACHIEVEMENTS

- In rice, BIPM consisting of (a) sowing disease-resistant variety, (b) seed treatment with *Pseudomonas* at8 g/ kg of seeds/ seedling dip in 2% suspension, (c) bird perches at 10/ha, (d) three to seven releases of *Trichogramma japonicum* at 1 lakh/ha at weekly interval (after observing egg masses) when either leaf folder or stem borer occurred, (e) spraying Bt at 2 kg/ha;2-4 sprays depending on pest occurrence, (f) spraying *P. fluorescens* (2.5 kg/ha) against foliar diseases, and (g) need-based application of botanicals against sucking pests has been recommended for rice-pests and diseases in Kerala, Asom and Punjab.
- Nine releases of *T. chilonis* at 50,000/ha at 10 days intervals were recommended for Asom against Plassey borer of sugarcane.

All-India Co-ordinated Research Project on Biological Control of Crop Pests and Weeds

Under the NBAII, the AICRP on Biological Control of pests and diseases has been strengthened with the project co-ordinator cell. Mass production of quality nucleopolyhedrosis, entomofungal pathogens, antagonistic fungi, antagonistic bacteria, mite pathogens, entomopathogenic nematodes and biological control of plant parasitic nematodes have been undertaken by this.

- Collection of 30 isolates of *Beauveria bassiana*, 15 isolates of *Metarrhizium anisopliae,* 16 isolates of *Verticillium lecanii,* 10 isolates of *Nomuraea rileyi,* and one isolate of *Paecilomyces fumosoroseus*, from various insect hosts was made from different parts of the country and maintained in the culture collection. Technology has been perfected using liquid ferementation for mass production of talc-based formulations of entomopathogenic fungi like *Metarrhizium anisopliae*, *Verticillium lecanii* and *Beauveria bassiana,* and solid fermentation using rice-grains and yeast granules for *Nomuraea rileyi*.
- Invert emulsion formulations of antagonistic fungi with shelf-life of 12 months have been developed. Formulations of nematophagous fungi have also been developed.
- Beta-tubulin gene (1 to 233 bases) from *Pochonia chlamydosporia* has been sequenced and registered in Genbank, NCBI, Maryland, USA (Accession number -DQ417603).

A website "Coccinellidae of the Indian Subcontinent" **(URL:www.angelfire.com/bug2/j_poorani/index.html)** has been constructed and hosted to serve as an identification aid for lady beetle. The site has image-galleries of over 100 species of common coccinellids found in Indian Agroecosystems and their natural enemies. This website is one of the few web-based identification aids available for Indian insects, and has been included in the prestigious entomology index of internet resources, hosted by Iowa State University, USA.

A website "Aphids of Karnataka" **(URL: www.aphidweb.com)**, giving diagnostic and biological information for 67 species of aphids has been constructed and hosted.

The Institute has lauched anticipatory strategic programme for invasive coconut leaf beetle. The devastating alien coconut leaf beetle *Brontispa longissima* has invaded several Asian countries and pacific islands.It has been reported lately from Myanmar and Maldives; posing a serious threat of invasion to India. The NBAII has conducted six sensitization workshops for creating awareness among the stakeholder entomologists from the SAUs, Coconut Development Board, KVKs, CIPM centres and Department of Agriculture and Horticulture from all over the country.

- In maize, for controlling stem borer (*Chilo partellus*), *Trichogramma chilonis* at 50,000/ha was released 6 times, starting from 45th day after sowing.
- In sugarcane, 8-12 releases of *T. chilonis* at 50,000/ha at a weekly interval, starting from 45th day after crop germination for control of early shoot-borer; 10-12 releases of *T. chilonis* from July to October at 50,000/ha at weekly interval are to be made depending upon the pest situation for control of sugarcane stalk-borer; 6 releases of *Trichogramma japonicum* on 60th day after crop germination at 50,000/ha at weekly interval for control of top-borer of sugarcane; 6-8 releases of *T. chilonis* at 1 lakh/ha at weekly interval, starting from 4-5 months after planting, for control of internode borer; inoculative releases of *Dipha aphidivora* at1,000 larvae/ha or *Micromus igorotus* at 2,500/ha at 10 spots was widely adopted along with conservation by avoiding chemical insecticidal sprays, which effectively controlled sugarcane woolly aphids.
- In Bt cotton, BIPM consists of (a) seed treatment with *Trichoderma* at 8 g/kg of seed, (b) border row of maize-crop around each hectare of crop, (c) bird perches at 10/ha, (d) 2-3 releases of *Chrysoperla* larvae (2- 3 days old) at 14,000 per hectare at weekly interval at later stage when aphids, incidence appears, (e) spraying of NPV for *Spodoptera litura* (1.5×10^{12} POB/ha) 'as and when' neonate larvae are seen, (f) initial spraying of Neem Seed Kernel suspension at 5%, (g) 2-3 releases of *Trichogrammatoidea bactrae* at 1.5 lakh/ha/week synchronizing with appearance of pink bollworm for Gujarat, Andhra Pradesh and Tamil Nadu.
- In pigeonpea, BIPM package consists of seed treatment with *Trichoderma harzianum* at 6 g/kg of seeds against wilt disease; soil application of *Pochonia chlamydosporia* at 20kg/ha and *Trichoderma harzianum* at 5 kg/ha (108 spores/g of formulation) at the time of sowing; at flowering stage if blister beetle or borers are seen, spray NSKE 5%; for *Helicoverpa armigera*, spray *Ha*NPV at 1.5×10^{12} POB/ha along with 0.5% crude sugar and 0.1% teepol when larvae are in the early stages. Sprays may be repeated if repeated attacks are seen; full-grown larvae can be hand- picked and destroyed; monitor also for other borers like blue butterflies, plume moths and *Maruca testulalis*. Repeat spray of NSKE 5% or Bt formulation at 2 kg/ha; maize can be grown as an intercrop (one in 10 rows of pigeonpea as bird perches)
- In mango, *Metarrhizium anisopliae* at 1.0×10^{9} spores/ml caused 77% mortality of mango-hoppers after 72 hr. Pre-harvest spray (35 and 15 days prior to harvest) of mixed formulation of *T. harzianum* (PBAP-27) and *P. fluorescens* (PBAT-43) at 10 g/litre with 1% Tween 20 and post-harvest dip in suspension of *P. fluorescens* was found most effective in suppressing post-harvest rotting in mango cv. Dasheri.
- Biological control of potato tuber-worms can be achieved by 4 releases of *Copidosoma koehleri* adults at 5,000/ha at weekly interval, starting from 45-50 days after planting in the field and inundative releases of *C. koehleri* at 5 pairs/ kg of tubers at fortnightly interval in the *arnies* where potatoes are stored.
- Seed treatment with talc-based formulation of *Trichoderma harzianum* (10g/kg of seeds) was effective in suppressing anthracnose in chilly.
- In soybean, BIPM package consists of release of *Telenomus remus* at 1 lakh/ha, 3 sprays of *S*lNPV at 1.5×10^{12} POB/ha along with 0.5% crude sugar; which effectively controlled *Spodoptera litura*.
- In vegetable-pea, seed treatment alone (*Trichoderma harzianum* PBAT-39 at 10g/kg) or in combination with foliar application of mixed formulation of *T.*

Papaya mealybug *Paracoccus marginatus*, a highly invasive pest, has devastated not only papaya but several other field crops—cotton, tapioca; vegetables—okra, brinjal, tomato, besides silk-cotton, mulberry, teak and a host of weed plants—parthenium, plumeria, *Acalipha indica, Tridex procumbens* etc. in India. The NBAII has introduced three parasitoids—*Acerophagus papayae, Anagyrus loecki* and *Pseudleptomastix Mexicana*. The parasitoids are expected to bring about substantial suppression of mealybugs within the year

Papaya mealybug

Anagyrus loecki

Acerophagus papayae

Pseudleptomastix Mexicana

harzianum (PBAT-39 at10g/litre) and *Pseudomonas fluorescens* (PBAP-27 at 10 g/litre) significantly reduced rust severity and increased grain yield.

- In tomato, fruit-borer incidence could be controlled with 6 releases of *Trichogramma pretiosum* or *T. brasilienses* at1 lakh/ha, after noticing activity of the fruit borer. Spray *H*aNPV at 1.5 × 10^{12} POB/ha along with 0.5% crude sugar and 0.1% teepol when larvae are in the early stages.
- In gherkin, incorporation of talc formulations of *Paecilomyces lilacinus* or *P. chlamydosporia* at 30 kg/ha along with vermicompost at 200kg/ha in furrows before sowing of seeds recorded highest infection of egg masses of root-knot nematodes, reduction in their populations in the soil and also reduction in root infection by them.
- In kole crops, control of diamond-back moth could be achieved by 6 releases of *Trichogramma brassicae* at 1 lakh/ha each time.
- In coconut, management of *Oryctes* was possible through integration of green muscardine fungus (GMF), *Oryctes* baculovirus (OBV) and attractant baited pheromone traps. GMF treatment in 5 pits of 1m ×1m × 0.5 m at 5 x 10^{11} spores/m^2 and OBV to be released at 12-15 infected beetles/ha and pheromone traps to be set up at 2 traps/ha. This technology is being popularized among farmers.
- In turf grass, control of white-grubs was achieved by *Beauveria bassiana* at 1 × 10^8 spores/ml at Srinagar.
- Successful control of water-hyacinth was achieved by the field releases of exotic weevils, *Neochetina eichhorniae*; *N. bruchi* in Disangmukh of Sibsagar district and more than 700 hectares of water-body could be cleared.

PRIORITY AREAS FOR THE XII PLAN

- Collection, characterization and cataloguing , and registration and exchange of agriculturally important insect resources.
- Development of identification tools and databases on agriculturally important insect resources.
- Quarantining, host-specificity, and field releases, of introduced natural enemies for alien crop pests.
- Classical biological control of papaya mealybugs and anticipatory programme for the coconut leaf beetle, *Brontispa longissima*.
- Development of protocols for mass production of beneficial insects.
- Nano-formulations of semiochemicals.
- Developing genomic database and library for insect resources in the country.
- Development of DNA barcodes for closely related groups of insects for their authentic identification.
- Genetic prospecting of insect resources for maintenance, conservation, utilization and improvement, and metagenomic analysis of insect-derived resources.
- Automation for solid-state fermentation for mass production of *Trichoderma* spp. and of entomofungal pathogens.
- Development of wettable powder formulations of entomofungal pathogens and *Pochonia chlamydosporia,* and formulations of antagonistic bacteria including *Bacillus thiringiensis.*

National Bureau of Agriculturally Important Insects
Post Box No. 2491, H. A. Farm Post
Hebbal, Bengaluru (Karnataka) 560 024
e-mail: rjrabindra@rediffmail.com

Horticultural Crops — Notified Varieties

Crop	Varieties	
Potato	Kufri Frysona(MP/98-71)	Recommended for release for cultivation in Uttar Pradesh, Haryana, Punjab and West Bengal, and is suitable for French-fries-making. It is of medium maturity, and has high dry matter content. Its average yield is 30-35 tonnes/ha
Onion	Hisar Onion 3(HOS1)	Recommended for release for cultivation in Haryana, Delhi, Rajasthan and Gujarat as *rabi*-crop under irrigated conditions. It is moderately resistant to purple blotch and is susceptible to thrips. Its average bulb yield is 32 tonnes/ha.
Pea	Vivek Matar 11(VP 233)	Recommended for release for cultivation in Uttarakhand, Himachal Pradesh and Jammu Kashmir under irrigated and rainfed conditions. It is resistant to powdery mildew, wilt, white rot and leaf blight.
Ash -gourd	Pusa Ujwal	Recommended for release for cultivation in Puducherry, Tamil Nadu, Kerala and Tripura in summer and in *kharif* season. It matures in 140 days and its average yield is 1tonne/ha under irrigated conditions.
Coriander	APHU Dhania 1(LCC 170)	Recommended for release for cultivation in Tamil Nadu, Haryana and Bihar, and matures in 75-95 days. Its average yield is 1tonne/ha under irrigated conditions.
Coriander	RC 728(UD 728)	Recommended for release for cultivation in Rajasthan, Uttar Pradesh and Haryana under irrigated conditions. It is of medium maturity.
Fennel	RF 205(UF205)	Recommended for release for cultivation in Rajasthan, Gujarat, Uttar Pradesh, Haryana and Bihar.It is of medium maturity,and its average yield is 1.6 tonnes/ha.
Coconut	Kerakeralam(IND 069)(CCS 9)	Recommended for release for cultivation in rainfed areas of Kerala and irrigated areas of Tamil Nadu and West Bengal. It is moderately tolerant to drought.
Coconut	Kera Bastar (IND 0045)(CCS 10)	Recommended for release for cultivation in rainfed conditions in Maharashtra and irrigated conditions of coastal Andhra Pradesh, Tamil Nadu.

Maize dehusker-sheller

A hand-operated, axial-flow maize dehusker-sheller with a capacity of 100-kg maize-cobs/h has been designed and developed for farm-women. The machine was tested at the feed rates of 60 kg/h to 140 kg/h for the peripheral cylinder-tip speeds of 4 m/s to 6 m/s to observe dehusking-shelling efficiency, grain -recovery percentage and grain-breakage percentage, and also power consumption. Average operation capacity of the machine was 80 kg/h for both in sitting and standing postures at a hand-cranking speed of 55 rpm. Grain breakage was found less than 1 % at the grain moisture content of 13.4 %.

The new machine will be suitable for marginal and small farmers of the plains and hilly areas. The estimated cost of the machine is Rs 17,000.

S.P. Singh
Directorate of Research on Women in Agriculture
Sub-centre, Bhopal (Madhya Pradesh)
e-mail:nrcwa@ori.nic.in

Psychrotolerant *Pseudomonas poae* from Uttarakhand Himalayas

Cold-tolerant, phosphate-solubilizing bacteria RT5RP2 and RT6RP were isolated from the rhizoplane of the wild-grass grown at 3,100 and 3,800 m above mean sea levels from Rudraprayag district of Uttarakhand on the nutrient-agar, strictly at 4°C.

Isolates identities were determined by morphological, biochemical and physiological characterizations and by 16S rRNA gene sequencing; which showed 99% similarity with the sequences of *Pseudomonas poae,* available in the public domain. The isolates grew at temperatures ranging from 4° to 30°C. *Pseudomonas poae* RT5RP2 and RT6RP solubilized 102.5 and 114.1 µg/ ml of P after 7days of incubation at 4°C with a progressive decline in *p*H. Apart from phosphate solubilization, they were able to produce IAA and HCN at 15° and 4°C.

P solubilization rate (k) was determined by using first-order kinetics for different times during incubation. By regression analysis, it was found that P solubilization kinetics best fitted in power models for the NBRIP-broth supplemented with Udaipur rock phosphate. The steep of the curve (k) obtained by gradually solubilized phosphorus by *Pseudomonas poae* RT5RP2 and RT6RP followed power model, and most of the P solubilization in the culture solution took place within 240 hours of incubation.

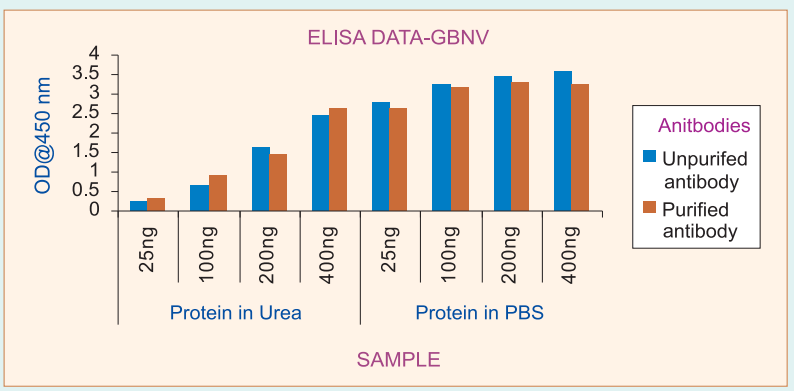
Pankaj K. Mishra, G. Selvakumar and **J.K. Bisht**
Vivekananda Parvatiya Krishi Anusandhan Sansthan
Almora (Uttarakhand) 263 601

ELISA kit for tospoviruses detection

Thrips act as vector for tospoviruses (family Bunyaviridae), important viral pathogens; affecting wide range of crop-plants in India. These viruses cause chlorotic spots, ring spots, mottling and yellowing of leaves, followed by necrosis of foliage, stem and buds, which result in stunting and death of plants.

For developing broad-spectrum serological diagnosis, polyclonal antibody (PAb) to the recombinant coat protein (rCP) of the groundnut bud necrosis virus was generated. CP gene of the groundnut bud necrosis virus was cloned, and an expression construct of it was developed in the pET vector; rCP was expressed in *Escherchia coli* and was used to generate PAb in rabbits.

An enzyme-linked immunosorbent assay (ELISA) kit has been developed by using PAb to detect three tospoviruses under serogroup-IV — capsicum chlorosis virus, groundnut bud necrosis virus and watermelon bud necrosis virus in the crude leaf extracts of various field samples. The sensitivity limit of the ELISA is about 25 ng of viruses. For commercial use, tospovirus kit has been licensed to Chromous Biotech Pvt Ltd, Bengaluru.



The necrosis disease caused by groundnut bud necrosis virus (GBNV) in groundnut and potato, and by watermelon bud necrosis virus (WBNV) in watermelon *(left)*. Detection of the virus by ELISA. Polyclonal antibody (PAb) to the recombinant coat protein of the GBNV was used at a dilution of 1:1000. Red and blue bars indicate cross-adsorbed and non-cross adsorbed PAb *(right)*.

Bikash Mandal and **R.K. Jain**
Plant Virology Unit, Division of Plant Pathology, Indian Agricultural Research Institute, New Delhi 110 012
e-mail: leafcurl@rediffmail.com

UNITED AGAINST HUNGER

On 16 October 2010, World Food Day enters its 30th year. This auspicious occasion also marks the 65th anniversary of the founding of the Food and Agriculture Organization of the United Nations. The theme of this year's observance is United against hunger, chosen to recognize the efforts made in the fight against world hunger at national, regional and international levels.

Uniting against hunger becomes real when state and civil society organizations and the private sector work in partnership at all levels to defeat hunger, extreme poverty and malnutrition. In this manner collaboration among international organizations particularly the Rome-based United Nations agencies [Food and Agriculture Organization (FAO), International Fund for Agricultural Development (IFAD), World Food Programme (WFP)] plays a key strategic role in directing global efforts to reach Millennium Development Goal 1 – Eradicate extreme poverty and hunger – which calls for halving the hungry people in the world by 2015.

The UN system and other players unite in FAO's Committee on World Food Security (CFS). The newly reformed Committee includes member countries but also UN agencies such as IFAD, WFP and the UN Secretary-General's High-Level Task Force on the Global Food Security Crisis, as well as other organizations working in the area of food security and nutrition. The Committee includes civil society, NGOs and representatives of all relevant people affected by food insecurity, as well as international agricultural research institutions, the World Bank, the International Monetary Fund, regional development banks, the World Trade Organization and will be open to the private sector and philanthropic foundations.

The Committee is now advised by a high-level panel of experts on food security and nutrition so it can make rapid and informed decisions.

In some 30 countries, national alliances composed of civil society organizations (CSOs) and government agencies are actively collaborating together to promote advocacy and awareness-raising activities and their involvement was further strengthened following the recent international consultation held at FAO headquarters in June 2010. National alliances are actively engaged in global mechanisms such as the expanded CFS and the High-Level Task Force to promote food and nutrition security.

The World Summit on Food Security, or the "hunger summit", held in November 2009, adopted a declaration renewing the commitment made at the 1996 World Food Summit to eradicate hunger sustainably from the face of the earth. The Declaration also called for an increase in domestic and international funding for agriculture, new investments in the rural sector, improved governance of global food issues in partnership with relevant stakeholders from the public and private sector, and more action to face the threat climate change poses to food security.

In 2009, the critical threshold of one billion hungry people in the world was reached in part due to soaring food prices and the financial crisis, a "tragic achievement in these modern days", according to FAO Director-General Jacques Diouf. On the eve of the "hunger summit", Dr Diouf launched an online petition to reflect the moral outrage of the situation. The "1 billion hungry project" reaches out to people through online social media to invite them to sign the anti-hunger petition at www.1billionhungry.org.

SIGN THE PETITION TO END HUNGER
WWW.1BILLIONHUNGRY.ORG

For further information – e-mail: world-food-day@fao.org

Approrpriate drills for fennel and cumin

Traditionally, fennel and cumin are sown by broadcasting or by manually dropping seeds in line. Bullock- and tractor- drawn seeders with manual dropping of seeds are also being used in some areas.

For propagation of good agricultural practice of line-sowing with mechanical seed-metering,use of a seed-cum-fertilizer drill (having 'vertical rotor with edge cells' as seed/ fertilizer metering mechanism) has been demonstrated, and preliminary trials on this were conducted at Piludra village and Jagudan Research Station of the SDAU. The drill use was also demonstrated at Gochnad village for sowing cumin along with tractor-drawn seeder (manual-seed dropping).

Seed-and-fertilizer metering mechanisms of the seed drill were acceptable to farmers, however, need was also felt for different types of furrow openers for placing seeds in the moist soil zone at the desired depth after removal of dry soil. So, a new design for furrow opener was developed to meet this special requirement of seed placement of cumin under un-irrigated areas. Nine units of each type of furrow opener have been fabricated to be used for sowing in irrigated and un-irrigated areas.

Fennel was sown in 16 hectares with seed-cum-fertilizer drill and the furrow openers during *rabi* 2009. Feedback of the farmers of Piludra village on the seed-cum-fertilizer drill for fennel was positive — it saved seed and time, compared to manual sowing.

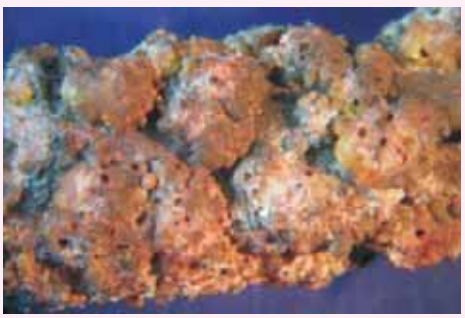
It was reported that with the use of the drill about 2-3 kg of seeds /ha could be saved (seed rate: 4 kg of seeds/ha in seed drill sowing compared to 6-7 kg/ha of conventional sowing). The seed drill gave coverage of 0.6 to 0.7 ha/h for sowing 3-rows at 90-cm row-to-row spacing.

Tarun Kapur and **B.K. Garg**
Central Institute of Agricultural Engineering
Nabi Bagh, Berasia Road (Bhopal) 462 038
e-mail: tkapur@ciae.res.in; bkgarg@ciae.res.in

Pre-summer mortality in *rangeeni* lac-insects

Large-scale pre-summer mortality of *rangeeni* lac-insects, especially in Jharkhand and West Bengal, has been reported in the recent years; affecting summer *rangeeni* lac production.

Studies were undertaken with lac cultures from natural lac-hosts —*bhalia*, *palas* and *ber*— from the samples collected from farmers' fields in Jharkhand and West Bengal. About 54% of lac-insects of the samples were found parasitized, showing unusual mortality in February, and nearly 25% parasitization was recorded in the apparently normal cultures. Percentage survival of lac-insects was only 20% in the affected samples and 52% in the apparently normal cultures. Caging experiment also confirmed heavy parasitization by *Aprostocetus purpureus*. Up to 573 parasitoids emerged from 10-cm lac encrustation in March. It was observed that parasitization before sexual maturity killed lac-insects invariably. Their survival was for the longer period when insects were parasitized after fertilization; but then also brood value and resin-producing efficiency were affected adversely. Thus, parasitization appears to be the major factor causing pre-summer lac-insects' mortality.



A. purpureus inside lac cells

K.K. Sharma, Md Monobrullah, J.P. Singh and **R. Ramani**
Indian Institute of Natural Resins and Gums, Namkum
Ranchi (Jharkhand) 834 010

Published by Dr T.P. Trivedi, Project Director, Directorate of Information and Publications of Agriculture, Indian Council of Agricultural Research, New Delhi 110 012. *Phone:* 011-25842787; *Fax:* 011-25843285, *e-mail:* tptrivedi@icar.org.in. Lasertypeset by M/s Print-O-World, Shadipur, New Delhi 110 008, and printed in India at M/s Royal Offset Printers, A-89/1, Naraina Industrial Area, Phase I, New Delhi 110 028.

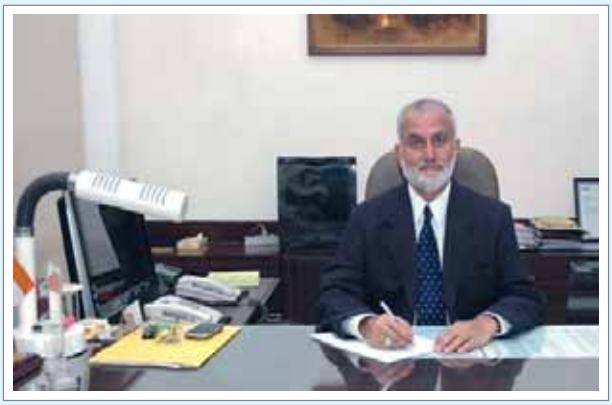
Editing : **Dr R.P. Sharma and Shashi A. Verma** ***Design & Production :*** **V.K. Bharti and Punit Bhasin**

WAY FORWARD

OF the estimated total of 80,000 plants with possible economic use, approximately 30,000 plants have been found edible in nature, and 7,000 have been cultivated by the mankind at one time or the other; but out of these, only 158 plants are used widely for food. Among these, 30 crops provide 90% of world's food, 10 supply 75% of world's food basket; and over 60% of world's total proteins and calories are provided by only three crops — rice, wheat and maize. Our food security, with such a high dependence on this narrow food-base, faces and will face high risk owing to growing uncertainties in the climate and emergence of new biotic and abiotic stresses. Consequently, there is a global concern to collect, introduce, evaluate and utilize vast array of lesser known, under-exploited, alternative crop-plants for diversifying agricultural systems.

India is the leading producer of small millets (fingermillet (ragi), kodo-millet *(kodo)*, foxtail-millet *(kangni)*, barnyard-millet *(sawan)*, proso-millet *(cheema)* and little-millet *(kutki)*. Annual planting area under them is around 2.5 million hectares; and nearly 1.5 million hectares is under fingermillet — 40–50% of crop's global area. During the last three decades, area under fingermillet has declined but with the significant improvement in the productivity (1,500 kg/ha), its annual production is maintained at around 2.4 million tonnes. At present, small millets account for less than 1% of foodgrains produced in the world. Their cultivation dates back to nearly 5,000 years, and in India, they form an important component of the traditional cropping systems and contribute significantly to the regional food and nutritional security and diversity in the national food basket; and they are important in areas of their production as dryland crops, as well as for hill agriculture. The small-millet grains have longer storage life, and hence can be termed as 'famine reserves'. The resilience exhibited by them may prove good for their adjustment to different ecological situations, and may make them potential crops for contingency plantings.

These millets are with high fibre content, and their protein quality and mineral composition contribute significantly to nutritional security of some of the most disadvantaged groups of people. They are rich source of phytochemicals and micronutrients also, and so are aptly termed as `nutricereals'. Epidemiologically, millets are beneficial for management of diabetes mellitus, cardiovascular diseases and gastrointestinal tract- related disorders. Thus, millets are strategic in terms of their food, nutritional and livelihood security and their role in local agro-ecosystems.



Dr S. Ayyappan, Secretary (DARE) and Director General (ICAR)

Food uses of millets have, however, been confined only to traditional consumers; limited especially to areas of their cultivation, and still have remained underutilized. Processing them using traditional as well as contemporary methods for preparation of value-added and convenience products would diversify their food uses. Their exploitation for preparation of ready-to-use products would help in their popularization among non-millet consumers and would improve economical condition of millet farmers.

Realizing their importance, in 1986 ICAR had launched an All-India Coordinated Small Millets Improvement Project (AICSMIP) at the University of Agricultural Sciences, Bengaluru, and 13 centres spread over the country to address research needs of the small millets. This project maintains one of the largest collections (13,296 accessions) of their germplasm in the world; besides, developing crop production and protection technologies for different regions of the country. With an increased awareness about their potential, they can be the 'future crops' for climate-resilient food production, and sources for genes for drought tolerance as well as for valuable and affordable proteins.

The future research on these crops needs to be focussed on making them more competitive through enhancing productivity and grains' quality and by diversifying their uses. The ICAR has a unique opportunity to be the world leader in small-millets research by employing cutting-edge technologies in their genomics, nutritional quality and value-addition.

(S. Ayyappan)
e-mail: dg.icar@nic.in