

implies that the contact network is highly 'clustered', in the language of network theory. In addition, a few 'long-range' connections can occur between individuals with no mutual acquaintances. Real societies also contain individuals who have contacts with far more people than the average, as for example, people who work in various service industries. Such 'hubs' of contact networks are obviously far more important in spreading infections than a typical member of such a network. Recent ideas concerning disease propagation on such complex networks suggest that the identification and selective immunization of such hubs might be a more effective and efficient strategy of containing infections than vaccination strategies aimed at an entire population.

A study of spreading on networks applied to computer networks was reported in the talk of Niloy Ganguly (IIT Kharagpur). Sudeshna Sinha (IMSc, Chennai) spoke about a cellular automata-based model of epidemic that also implemented similar complex network connections. The related class of excitable media models were shown to reproduce many observed spatial and temporal patterns of epidemics in the talk by Sitabhra Sinha (IMSc, Chennai). In particular, these models explore how infections may apparently disappear and come back after a significant interval of time. Gautam

Menon (IMSc, Chennai) briefly introduced the basic ideas of agent-based computational models to simulate the actual spread of infections in geographically and community-wise structured urban settings.

The spreading of infectious diseases can be modelled at many levels of description, ranging from the single cell to the tissue, organism and society. Modellers distill, from this complexity, those components which admit a mathematical or computational description. An important component of the meeting was discussion sessions aimed at identifying the questions which could be addressed by modelling. Much was clarified in these discussions and we summarize their conclusions here: Micro-level and macro-level phenomena cannot be strictly compartmentalized, even though the principles governing the modelling may differ superficially. Biologists tend to see the underlying complexity in predicting infectious disease progression and may not necessarily make the distinction between what is less important and what is more important in terms of abstracting to simple models. In contrast, modellers tend to simplify matters first and then to construct models in which such simplifying assumptions are built in from the start. There is thus a need for continued interaction between these communities to reconcile these very diverse approaches;

until a common language is developed, understood and assimilated by the interacting partners, fruitful collaborations are unlikely to emerge.

The other point made was that modellers require access to data to evaluate model predictions and make suggestions for data acquisition, but often have no idea where such data might be available. Data sharing requires, typically, a formalized arrangement between those who collect clinical and epidemiological data and users of such data, but the general feeling at the meeting was that negotiating such access for academic purposes would not be a problem. Material which relates to such data, describing the type of data available and listing persons who may be contacted in this regard, will be placed on the meeting website. Those interested in establishing contact with a broader set of scientists and applied mathematicians interested in the problems of infectious disease modelling are urged to write to the conveners of this meeting.

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MEETING REPORT

Biological control of insect pests and diseases of forestry importance*

E. Meru, Rain Forest Research Institute (RFRI) in his presidential remarks said that the seminar was a platform for the scientists to discuss and exchange their ideas and knowledge about the importance of biological control, use of botanicals, genetic engineering, etc. A. K. Pathak, Director of Research, AAU, Jorhat inaugurating the seminar stated that there was

a great need to intensify research on biological control because indiscriminate use of chemical pesticides have polluted the environment to such an extent that the biodiversity of the region has been threatened to extinction. They get accumulated in the food chain thereby causing great harm to human health.

L. K. Hazarika, Entomology Department, AAU, in his keynote address, highlighted various insect pests of forestry importance, their damage potential, and available natural enemies against those insect pests. He emphasized that the biological control approach is the only suitable method for forest insect pest

management. An invited lecture was delivered by B. G. Unni, RRL, Jorhat and he described the plant based bio-control against various insect pests and diseases and listed their biochemical and functional properties very briefly.

In the lead lecture of the first technical session, B. K. Borthakur of Tocklai Experimental Station, Jorhat described the prospects of biocontrol of tea diseases in northeast India. He stated that due to continuous application of pesticides, many pests and pathogens in tea plantations become resistant to them. To overcome this, efforts must be made to isolate and identify some indigenous bio-control agents.

*A report of the seminar on Recent Trends in Biological Control of Insect Pests and Diseases of Forestry Importance sponsored by Department of Science and Technology, New Delhi, held on 18 September 2006 at Rain Forest Research Institute, Jorhat.

K. C. Puzari, AAU, described some aspects of microbial control of forest diseases which is one of the potential alternatives to chemical pesticides for plant disease management.

G. Gurusubramanian of Tocklai Experimental Station, Jorhat described the abundance and efficacy of bio-control agents through novel approaches. He explained various novel approaches such as push and pull strategy, info chemicals, precision agriculture, genetic engineering technology, crop management tactics and mass rearing technology to maximize the abundance and efficacy of bio-control agents in various agro-ecosystems. P. R. Bhattacharyya of Regional Muga Research Station, Central Silk Board, Kamrup presented a paper on biological control of Uzi fly – a parasite of muga silkworm. He described that biological control is the only answer to manage the Uzi fly menace. Control of Uzi fly through chemicals is not practicable be-

cause of the outdoor nature of muga rearing.

In a lead lecture of the second technical session I. C. Baruah, AAU, discussed the importance of biological control of invasive alien weeds *Mikania micrantha*, *Eichhornia crassipes*, *Parthenium hysterophorus* in respect to crop productivity. P. P. Neog, AAU, presented two papers. In his first presentation he described the efficacy of VAM-fungus *Glomus fasciculatum* alone and in combination with neem cake and carbofuran for management of root knot nematode *Meloidogyne incognita* in greengram. His second presentation was on occurrence and distribution of *Pasteuria penetrans* in root knot nematode infecting some vegetable crops from Golaghat and Jorhat district of Assam. Mantu Bhuyan, RRL, Jorhat discussed the efficacies of plant extracts of *Acacia farnesiana*, and *Acorus calamus* for controlling insects pests. H.

Chingthangkomba Singh, Manipur University, Imphal spoke on the thrips diversity in north-east India. M. Gogoi, Gurgaon College, Simaluguri, discussed the successful use of traditional practices in control of insect pests of host plants of Muga silk worm in lieu of chemical pesticides. He also noted that the fragrance of *Litsaea cubeba* plants has self-controlling power over some particular insect pests. S. R. Borah, AAU, presented a paper on interactions of host-parasitoid interactions of *Helicoverpa armigera* and *Campoletis chloridae*. M. Islam concluded with a brief summary of the presentations.

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COMMENTARY

Geographical indications and agriculture-related intellectual property rights issues

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The last three decades witnessed a very impressive growth in agriculture, food production and as a result food became easily available to people below the poverty line. But gradually there has been a stagnation in crop production¹ and the soaring input costs and low output prices are attributed as the main reasons for the desperate life-ending-steps that some of the farmers have resorted to². The deceleration in agricultural growth is a point of great concern and several administrative and policy initiatives have now been drafted or put in place. Indian agriculture grew at 3.9% during the current quarter which clearly shows that adjustments are taking place. The present situation in agriculture is partly due to the fact that Indian agriculture has not fully adjusted itself to the global realities.

Having reaped the benefit through the seeds of green revolution varieties, farmers were quick to realize the importance of good seeds of new and better varieties

of crops. For such superior seeds, farmers were all the more willing to pay a higher price. Seed companies and technology developers saw this as an opportunity to convert plant varieties and important plant genes as profit-making products^{3,4}. Also, as a global strategy, pesticide and seed companies merged to consolidate capital and technology to dominate the market. In various world fora the need to conserve biodiversity, farm level variation, giving credit to farmers for their traditional crop varieties, folk varieties, farmers' variety, access to benefit sharing, extending consumer assurance by way of geographic indications, appellation of origin, traditional knowledge of medicinal plants are discussed to draft several treaties and agreements. Global commodity trade is now dominated by several such new issues, which in India are still not seriously debated and understood.

The carry-over of the colonial agriculture in Independent India was simplistic

in the beginning. Attention was drawn towards the implementation of land consolidation, its distribution, irrigation/water resources sharing procedures, execution of fertilizer and pesticide-related Acts and Rules. They were done to ensure the quality of inputs supplied to the farmer. Also mandi/market reforms and cooperatives were put in place along with sound public distribution system to address the issue of equity and fair access to food. All these policy initiatives did contribute to the success of green revolution and towards substantial growth in agriculture and allied sectors.

The Indian Parliament enacted in 1999 'The Geographical indications (GI) of Goods (Regulation and Protection) Act' for registration and better protection of geographical indications relating to goods. Under Section 1(e) it is defined that 'Geographic Indication' in relation to goods, means an indication which identifies such goods as agricultural goods,