EDITORIAL

The genesis of this special issue on Biopesticides lay in the problem of pesticide residues that was focused in the last issue of the IJTS 2(4). In the ecosystems where large numbers of natural enemies of tea plant have co-evolved, the tea plant faces a battle for dominance. To tilt the balance in favor of an economic crop of tea, the planter employs large number of pesticides repeatedly to keep the pests in check, which has undesirable consequences.

Biopesticides have a significant role in keeping the high yielding tea crops safe from pests and the produce free of harmful pesticide residues. Five specialists have contributed well-written papers for this special issue. Two eminent scientists edited this special issue of IJTS. Dr. A.N. Mukhopadhayay, former Director General of Tocklai, is an expert in antagonistic fungi. Dr. Nalini Gnanapragasam led her group of entomologists in biological control of pests at TRI Srilanka, where the work on bio-control of tea insect pests was initiated in early 20th century.

Carol Ellison's well-documented case study on biological control of *Mikania* was commended for its novel approach. Very little work has been carried out on this aspect of weed control. This paper will no doubt motivate the young weed scientists in traditional Tea Research Institutes to take up studies on employing mycoherbicides as a useful component in Integrated Weed Management. Special programmes should be designed to test plant pathogens for biological control of weeds that are difficult to control with chemicals some examples of these notorious weeds are *Polygonum chinense*, *Pteridium aquilinum* & *Nephrodium spp*. (ferns) and *Borreria hispida* (bagrakote). They should also research invasive weed species like *Ageratum conyzoides; Cyperus spp.* (sedges), *Imperata cylindrica* (thatch), *Saccharum spontaneum* (sun grass) & C.

Pesticide suppliers to the tea industry are not interested in developing myco-herbicides because there is little money for them. These bio-control agents kill the target species over large areas, without boundaries or limitation of ownership, and continue to be effective for years. Hence the research and implementation of Classical Biological Control (CBC) programmes must be funded by public money and underwritten by the Governments, Tea Boards, Producers' Associations or Tea Exporters (to keep the product residue free).

Seema Wahaab coordinates the Mission Mode Project of the Department of Biotechnology Government of India, on biological control of crop pests. Some far-reaching research projects have been initiated on bio-control of tea pests. Her status report attempts to compile information on bio-control agents such as parasites, predators and fungal, bacterial and viral pathogens which have a strong potential to provide effective alternatives to chemical pesticides used extensively in tea. This background information provided an excellent opportunity to pinpoint the problems in using bio-control agents to replace the chemical pesticides. It could also identify the gaps in bio-pesticide research for designing future thrust areas of research.

Chinese tea plantations are hosts to 800 species of insect mites & pests and 133 species of plant

diseases. Bao-yu Han traces the changing pattern in the use of chemical pesticides in Chinese tea gardens since early 1950s, starting with DDT and BHC. Pesticide residues in the Chinese tea produce seriously exceeded the prescribed standards for various pesticides until the year 2000 when the regulatory agencies were alerted to the need of switching over to better phytosanitory techniques and bio-control agents. Effective regulation of chemical pesticides brought down the number of Chinese tea samples bearing excessive pesticide loads to less than half a percent (0.4%) in 2002.

Amongst the natural enemies of tea pests in China, Han's paper lists 290 species of predatory spiders, 119 species of insect parasites & predators, 69 viruses, Bt based insecticides and several species of entomogenous fungi for insect pests and mites. Diseases like blister blight, leaf spot and gray blight are important only in certain specific tea growing areas of China. A bacterial broth is reported to control important diseases. Pheromones for insect traps have been used effectively in combination with biocides. Strangely there is neither any mention of research on antagonistic fungi against tea diseases, nor of any botanical insecticides. Knowing the traditional Chinese treasure trove of herbals, it is difficult to understand how they missed the use of botanicals as bio-control agents in tea. Quantification of the commercial acceptance of biocides and comparison of their efficacy with chemical insecticides would have been useful.

Plant kingdom is considered to be a natural factory of phyto-chemicals, which offer viable and effective alternatives for pest management. Over 2000 plant species have been identified for possessing insecticidal properties. Amongst the botanicals, neem commands a special place as an effective biocide for many tea pests, with its multiple biological effects. These include anti-feedant, repellent, oviposition deterrent, growth regulation properties and eco-friendly nature. The well documented review of S. Ramarethinum focuses on the positive role of neem and its derivatives in controlling tea pests in an eco-friendly manner. The paper discusses mode of action of 4 major and >20 minor active constituents of neem for its insect management properties. Higher cost of pest control with biologicals is justified for cleaner product and better environment safety.

Natural enemies of tea pests have co-evolved with their preys. B. Banerjee has employed a novel approach of a well-known management technique of SWOT analysis for a critical appreciation of the predator-prey relationship using one model pair of a predator and a pest. He refutes the theory that in the pre-pesticide era the natural enemies were more abundant than in the post-chemical regime, with an argument that the crop losses were greater at that time than they are today. This does not negate the crucial role of natural enemies in preventing pest outbreaks. Rather it confirms the contention of Petch (1925) from Srilanka, cited by Wahab who was pessimistic about natural enemies eradicating any insect pests of tea. Faith on the effectiveness of co-evolved natural predators in preventing the immediate crop losses may, thus, be misplaced. However, skillfully adjusting the number, timing and volume of pesticide sprays would play a significant role in taking advantage of naturally occurring predators for economic management of pest populations. After an insecticide spray, the depleted population of predators builds up linearly while pests resurge at compounded rates. Predators, unlike the

pests, fail to reach the original levels quickly. This observation cannot be lost sight of by the researchers engaged in searching effective predators/parasites against insect pests of tea.

Five bio-control papers are presented in this special issue of the International Journal of Tea Science (IJTS). But the need is felt for a subsequent special number of IJTS on bio-pesticides to throw light on performance of many other bio-control agents. The identified gaps include bio-control with viruses; bacterials like Bt; fungal antagonists; entomophagous fungi; entomogenous nematodes; parasites & predators; pheromones; arthropods against weeds; botanicals (other than neem); role of rhizosphere microbes, phylloplane organisms; pest populations as influenced by nutrients and environmental factors like shade, pH, moisture; impact of allelopathic cover crops on succession of weeds in young tea and the ultimate Chemical-less (organic) tea. Authors and specialists are invited to write on the subjects of their expertise for this future issue. Detailed information on this appears on a full page* elsewhere in this issue.

The International Society of Tea Science (ISTS) undertook a new activity when it organized jointly with the Tea Board India, the 3rd International Conference on Global Advances in Tea Science successfully in Kolkata November 20-22, to discuss the "**Impact of Science on the Economy of the Tea Industry"**. Judging by the quality of papers presented by the speakers and the enthusiasm of the delegates, the conference was a success. We are grateful to Dr. Maqsood Siddiqi, Director Bose Institute and his colleagues, who undertook the entire arrangement without much help from the Head Quarters of ISTS. To me personally this event was reminiscent of Tocklai conferences in the seventies for its proactive interaction. This occasion helped start **<http:\teascience.org>** website where activities of the Society are listed and updated. Proposal is afoot for this website to register profiles of our members and for hosting titles of tea science abstracts for wider readership.

Your Resident Editor has a support now. Dr. P.N. Rustagi who retired as a senior scientist after serving Tocklai for several decades, and was a consultant with major tea companies, has agreed to assist in editorial work, and keeping the printer's devil at bay. You will enjoy more of the IJTS reading. Welcome to Dr. P.N. Rustagi, on behalf of all the Society members.

Your Society has completed six years of its existence as a registered body and four years with its present name of International Society of Tea Science. The current 100 members of Society (as on January 1, 2004) are listed in the last pages of this issue. The Society is holding its first-ever elections in the General Body Meeting, which is called on March 20, 2004, where the members will elect a new generation of dedicated Office Bearers and an active, young Board of Management (Executive Committee). All the members are requested to participate. Suggestions are invited to help make this society an active body in the service of the tea community.

Delhi
Mach 7, 2004

N.K. Jain
Resident Editor IJTS
& Secretary ISTS

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