MEETING REPORT

Litchi fruit borers*

Litchi (*Litchi chinensis* Sonn.) is one of the important subtropical fruit crops contributing significantly to the growers' economy in Bihar, Uttarakhand, Uttar Pradesh and West Bengal in India. Among several factors affecting the production and productivity of litchi, insect pests are of major concern. Among them, fruit borer complex mainly comprising *Conopomorpha* spp. (Lepidoptera: Cossidae) has become a serious problem in the recent past causing 40–80% yield loss. The caterpillars enter the fruit from the pedicel end and feed on the pulp resulting in rotting and premature dropping of fruits. Besides fruits, they also bore tender shoots. Presently, insecticides are being used heavily for management of litchi fruit borers. Considering the safety to the consumers as well as environment, it is highly undesirable to depend solely on chemical pest management. Hence it was felt that there is an urgent need to take stock of the situation of litchi fruit borers and identify research gaps which could form the basis to develop safe and effective management strategies. With this background a national level conference on litchi borers was recently organized.

The meeting was attended by researchers in the disciplines of entomology, plant pathology and horticulture from ICAR institutes and State Agricultural Universities. The session started with a welcome address by S. D. Pandey (ICAR-NRCL, Muzaffarpur). P. V. Rami Reddy (ICAR-IIHR, Bengaluru) explained the essence of the conference. While introducing the topic, he highlighted that the Horticulture Science Division of ICAR has been giving special attention to address the borer problems in horticultural crops across the country through the network project CRP on Borers. As systematic studies on litchi pests in the country are still at nascent stage, NRCL should take lead in generating information on species complex, distribution, bioecology and natural enemy complex of litchi fruit borers. The relevance of the ecology of pests while formulating management practices has been duly emphasized. A. Krishnamoorthy (formerly at IIHR, Bengaluru) laid emphasis on the networking of all litchi researchers in the country and documenting species diversity of borers, which is a prerequisite to evolve non-chemical means of management like pheromones, biocontrol, etc. He added that NRCL and the centres of All India Coordinated Research Project on Fruits working on litchi should collaborate to develop geo-maps of species-wise distribution of litchi fruit borers. The scope of biocontrol agents, especially egg parasitoids and entomopathogens like *Beauveria bassiana* in borer management was elaborated. In his presidential remarks, Vishalnath (ICAR-NRCL, Muzaffarpur) expressed concern that fruit borer has been inflicting serious losses to litchi growers, and hence concerted efforts to explore both short- and long-term strategies for borer management are the need of hour. He also appreciated the initiative taken by CRP on Borers to organize an exclusive meeting on litchi borers and assured that NRCL would be in forefront to implement the suggested technical programme and coordinate the centres working on litchi borers.

The technical session started with Kuldeep Srivastava (ICAR-NRCL, Muzaffarpur) presenting a status paper on litchi borers, including diversity, population dynamics and existing management practices. He mentioned that three species of borers, viz. *C. sinensis*, *C. cramerella* and *C. litchiensis* are reported to occur in India. However, the correct species identity and their proportion remain unresolved and under-studied. Earlier, *C. cramerella* was considered to be the dominant species. However, subsequent molecular identification of the specimen revealed that the species was in fact *C. sinensis*. Another interesting aspect of the presentation was the fact that rainfall during April–May months triggered severe incidence of borers. It was also mentioned that since litchi is an introduced crop with relatively narrow genetic base, the scope of host plant resistance is limited.

H. S. Singh (Central Horticultural Experiment Station, Bhubaneswar), while presenting the borer status in Odisha, underlined the scope of entomopathogenic nematodes against pupal stage of borers. The poor collection of moths in pheromone traps used in India could be attributed to wrong identification of the species, as they are primarily meant for cocoa borer, *C. crameraella.* Hence it is advisable that the chemistry identified for *C. sinensis* elsewhere can be synthesized and evaluated. According to him, crop habitat management has a greater role to play in borer management. Since larvae are cryptic in their feeding habit, he mentioned that fogging and spraying inert clay material to block the entry of larvae might be useful.

P. D. Kamala Jayanthi (ICAR-IIHR, Bengaluru) presented the scope of semiochemicals and the essentiality of understanding insect behaviour in litchi fruit borer management. She emphasized the importance of correct species identification for achieving success in pheromone studies, as even population differences could impact pheromone performance. She mentioned that the basic components of pheromones identified for *C. cramerella* and *C. sinensis* are the same, but differ in their proportion. It was stressed that understanding the insect behaviour and identifying alternate hosts are crucial to devise pheromone and kairomone-based interventions. Understanding the calling behaviour of female moths is a crucial aspect. She also mentioned that from the litchi fruit samples collected by her team from Kodagu, Karnataka, another species of borer (*Deudorix epijarbas*) was recorded, thus adding a new dimension to the species complex of litchi fruit borers.

Rajesh Kumar (ICAR-NRCL, Muzaffarpur) briefed about the success story of borer management being adopted by some farmers using systemic insecticides. J. C. Prabhakar (Bihar Agricultural University, Sabour) reported that exploiting endosymbionts like incorporating incompatible *Wolbachia* could be explored. S. K. Purbey (ICAR-NRCL, Muzaffarpur) brought out an interesting

*A report on the national level 'Round Table Conference on Litchi Borers' jointly organized by the ICAR-National Research Centre for Litchi (NRCL), Muzaffarpur and Consortia Research Platform (CRP) on Borers on 4 December 2015 at NRCL as part of ICAR-CRP on Borers.

observation that fruits bagged for improving quality and shelf life had significantly lower borer damage, and thus it would be worth assessing the feasibility and cost effectiveness of the practice.

The deliberations threw open the action points to be considered for chalking out the modules for management of litchi borers. Resolving species complex using both the conventional and molecular taxonomy was agreed upon as the most immediate need of the hour. It was suggested that all the AICRP (Fruits) centres dealing with litchi should be provided with pheromone traps of *C. cramerella* to understand the biodiversity of borer complex. Another lacuna in the present understanding of borer is its biology. For this, it is essential to develop a protocol for laboratory rearing of fruit borer. For example, the site of pupation and off-season survival are still ambiguous and they should be established to understand the positive impact of rainfall on the infestation of fruit borer. Regular monitoring of fallen fruits was suggested to find stage-specific infestation. Krishnamoorthy was optimistic that egg parasitoids (*Trichogramma* spp.) could help in minimizing the borer incidence, and both indigenous and exotic species are to be evaluated. Before the long-term measures start yielding implementable results, it was felt that safer molecules like IGRs, *Bt* and entomopathogens should be evaluated to be included in the IPM package. Since spraying of systemic insecticides like thiacloprid and imidacloprid is reported to be effective against fruit borers, residue analysis of these chemicals is mandatory before recommending the schedule. Responsibility of executing these activities was assigned to different institutes and centres according to the expertise and infrastructure available with them.

The meeting was followed by a visit to experimental plots and laboratories of NRCL Litchi.

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MEETING REPORT

Palaeoanthropology*

In comparison to other subjects in Indian archaeology and Quaternary studies, palaeoanthropology has declined significantly in recent decades as a prominent academic discipline in the Indian subcontinent. Most archaeological research and teaching in South Asia are largely focused on younger time periods, primarily the protohistoric/Chalcolithic and historical phases. In addition to lack of general interest as well as popularization, another major reason for the decline in palaeoanthropology may be the methodological challenges in interpreting complex palaeoanthropological records, e.g. landform assemblage, palaeoenvironmental reconstructions, assessing contextual integrity of the archaeological evidence (compared to younger sites), etc. Due to inadequate preserved evidence compared to younger archaeological sites, the study of human history during the Quaternary demands a multidisciplinary approach with highly sophisticated and extensive field-based surveys and integrated scientific analyses from geological perspectives. In comparison to those periods where individual sites are extensively studied, Quaternary research involves geological and geochronological questions in relation to landform-based climatic interpretations and ecological reconstructions. In the past, palaeoanthropological research has often focused on just reporting new Palaeolithic or palaeontological occurrences and artifact descriptions and basic assemblage compositions. What is now required from palaeoanthropological sites are data and interpretations from within Quaternary studies such as palaeoenvironmental reconstructions, geochronology, palynology, sedimentology, geomorphology and vertebrate palaeontology. Unfortunately, very few academic departments and institutions are able to offer students and researchers a platform to learn and apply the practical and multidisciplinary methodological aspects of palaeoanthropology, such as, surveying for lithic and fossil sites; excavating and documenting palaeontological, palaeolithic and rock art sites; proper logging of relevant stratigraphic sections and correlating regional stratigraphy; proper sediment sampling for relevant geochronological applications, etc. Moreover, most students who learn about such topics through classroom lectures are rarely given opportunities to visit relevant sites to understand first-hand information and appreciate geological contexts, geographic and ecological settings, and the manner in which such sites are identified. The lack of such multidisciplinary applications and knowledge centres may also be responsible for lack of interest in palaeoanthropological research.

To address all these issues, a multidisciplinary palaeoanthropology field school was conducted with the primary objective of planting an 'anthropology' seed in the minds of the young researchers for developing future research in this field. The Central Narmada Basin near Hoshangabad, Madhya Pradesh was selected for field lectures and demonstration of methods, as the region preserves evidences of a rich diversity of prehistoric archaeology, Quaternary geology and fossil sites. Thirteen participants were selected on the basis of their areas of interest/study, geographical locality and statement of purpose. They included faculty, doctoral researchers and postgraduate students in diverse areas such as geology, archaeology and history. The participants hailed from different states of India and also from Bangladesh.

All participants were taken to key palaeoanthropological sites and Quaternary type-sections in the region such as Hathnora, Surajkund, Dhansi and other comparable occurrences to teach them

*A report on the 'Palaeoanthropology Field School' held in Central Narmada Basin near Hoshangabad, Madhya Pradesh, from 23 to 29 December 2015.