

Meeting Report

Fruit flies: A major challenge in fruits and vegetable growing and their export from India



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The Fruit Fly Workers meeting held at the Bidhan Chandra Krishi Viswavidyalaya on 7th August provided a unique platform to scientists working in the eastern and north-eastern parts of India on fruit flies to interact, share their experience and finally to prioritize areas for future Research. The meeting started at 12:00 noon on 7th of August and continued till 5:00 pm and was attended by 31 participants. The programme was inaugurated by Prof. D. D. Patra, Hon'ble Vice-Chancellor, Bidhan Chandra Krishi Viswavidyalaya (BCKV) and was chaired by Professor C. Sen, President of Association for Advancement in Plant Protection (AAPP). Other dignitaries attended the meeting were Prof. T. K. Maity, Dean, Faculty of Horticulture, BCKV and Prof. M. R. Ghosh, Taxonomist and Retired Professor of Agriculture Entomology, BCKV.

The meeting was held in two sessions: inaugural session and brain storming session. In the inaugural session, Prof. Shantanu Jha, Professor and Head, Department of Agricultural Entomology, BCKV and Secretary, AAPP made an appraisal of the fruit fly problem and loss accrued due to fruit fly infestation at the global level. Prof. Jha pointed out that determining density and distribution of fruit fly populations in the field has been one of the issues of fruit fly management. He referred to the different works enlisting fruit flies from India. About 325 species of the pest has been reported to occur in the Indian sub-continent, of which 205 species are from India alone including both dacine and non-dacine species. He

briefly enlisted the important fruit fly pests occurring in the country, their spatio-temporal variations in different regions of our country and estimated crop loss by each of these pests. He also reviewed the DIFD funded project, 'Integrated Pest Management of fruit flies in India', which was implemented in 2002-2005 under the leadership of Professor John D. Mumford, Imperial College, London. It was a comprehensive work where, for problem definition key information survey, studies on ecology and abundance and semi-structured interview method for information collection had been followed. Experimental studies of on-farm management of fruit fly and village level surveys on those had been conducted to assess the performance of the existing management practices that were being followed by the farming communities in different parts of our country. Finally, as an outcome of the project, the South-Asia Fruit Fly Network had been built-up and SAFFN newsletter had been brought out.

But other than Orissa, not much information could be generated from eastern and north-eastern part of India from the project. He reported about the works being done on fruit flies at BCKV. For example, the students get exposure to fruit flies research from the under-graduate level. At the Post Graduate level, a number of students have carried out masters thesis research on fruit fly problems in important agricultural and horticultural crops. Research work under Ph.D programme and also through All India Coordinated Research Projects (AICRPs) on vegetables and

fruits along with adhoc research projects are being conducted on *Bactrocera dorsalis*, *B. zonata*, *B. cucurbitae* and *B. minax*, the dacine species prevailing in West Bengal.

The Association for Advancement of Plant protection, AAPP has implemented area-wide fruit fly control programme on mango at Malda during March to August, 2016. The project covered 11 villages in the block of Englishbazar which was funded by NABARD. As a part of capacity building, series of trainings of the orchardists had been done. Live demonstration of fruit fly life cycle and damage symptoms caused by those was found to be a very useful as training method. Methyl eugenol trapping @ 8 traps/acre and application of jaggery along with pesticide at the trunks of the plants had been demonstrated.

The following are some of the important facts that Prof. Jha drew the attention of the audience:

- a. Certain species of tephritid fruit flies are amongst the world's most notorious pests of commercially important fruits and vegetables.
- b. Trapping these flies is vital for identifying infestations, controlling detected populations and establishing guidelines for international transport of agricultural commodities, and

Prof. Jha emphasised on the following priorities for efficient management of fruit flies with special reference to Eastern and North-Eastern India:

1. Mapping of fruit fly infestation with reference to species diversity, host range, crop loss assessment, pest carry over especially in the hot spots is a necessity from this region.
2. As is common in fruit fly, no comprehensive repository of factual or theoretical material relating specifically to trapping issues of economically important Tephritidae of Eastern and North-Eastern India is available.
3. Identifying the possible fruit fly workers, establishing a network amongst them and preparing a repository from this region can be an outcome of this meet and its follow-up. This will help us identifying knowledge and information gap on

the problem and help in taking up need-based initiative.

The big challenge for researchers and managers of action programmes is to choose the best trapping system available for a particular growing area or region and for a species or group of species. Four critical parameters involved are: trap type, fly attractant, trap density and service interval. Once such parameters are defined, the operation and logistics of the surveillance network need to be planned to provide the most accurate possible estimates of the actual fruit fly populations in the field. This is an obvious fact that, owing to the large number of uncontrolled variables, field research on tephritid trapping typically produces probabilistic conclusions, not absolute ones. Changes in weather (particularly temperature, rainfall and humidity, wind speed and direction), inter-site differences (e.g., in climate, host plant availability and predation risk) and spatio-temporal variability in test results.

Dr. P.V. Rami Reddy, Principal Scientist (Entomology), ICAR- IIHR reported that IIHR has been working on fruit fly management under the guidance of Dr. Verghese. He started the presentation with a general overview of fruit fly and highlighted the major commodities that fruit fly damages. He pointed out that research in IIHR is focussed on Mango fruit fly (8-10 species). Major themes of IIHR research are crop sanitation (collection and destruction of fallen fruits), MAT (male annihilation technique), Bait splash (spraying the trunks baits +insecticide like deltamethrin) and chemical control of fruit fly. IIHR popularized cost effective traps using Methyl Eugenol. He highlighted that trapping is not a single solution. Other alternative control measures can be biocontrol (lack of parasitoids), bagging fruits (not practically feasible in tall plants, old orchards). The sterile insect technique (SIT) could be a very effective technique for fruit fly management. He provided an overview of the SIT technique. In India, very few researches have been carried out in this area. IIHR is targeting the ecological islands for fruit fly management in Mango and he highlighted that in a map. He reported that collaborative pilot project was started in 2004 with Bhabha Atomic Research Centre.

The progress made so far include standardization of radiation doses for *B. dorsalis* and *B. cucurbitae*, understanding the right age for the pupae to be sterilized and development of artificial diet. The optimal dose was found to be 30-100 Gy (50-60 Gy was found to be optimal). Dose and pupal emergence was found to be inversely related. *B. cucurbitae* is more sensitive than *dorsalis*. A semisolid medium was developed for rearing of *B. dorsalis*. This protocol can be scaled up if required. Advantages of SIT are that it is species specific and can be integrated with other control methods. However the problems are like delayed effects, immigration of gravid females and higher initial costs and requirement of government clearance. He also highlighted the gaps in fruit fly research *i.e.*, lack of taxonomic support, understanding of HPR mechanisms, applications of biocontrol, development of female attractant and implementation of pilot studies for SIT.

Dr. G. Markandeya, Managing Director of ATGC Biotech Pvt. Ltd. made a presentation on semiochemicals and aliphatic intermediates synthesised by ATGC. His talk was on the use of semiochemicals to control pests without using pesticide. His company focusses on different major pests of crops and have developed 44 different pheromones. His idea was to do away with the trap system in fruit fly control. In view of that they have been used a rubber base media, microencapsulated with beads of pheromones. Besides there are various delivery technology they have developed to release pheromones at different situations. The company have focused on national pest issues, for example, they have worked on Citrus Leaf miner, Red palm weevils in Saudi Arab. They also have worked on fruit fly control in Lebanon under the guidance of USDA. Dr. Markandeya mentioned that this wax based material (Splat®) can be used for pheromone application even during rainy season. He mentioned that their company works in collaboration with NABARD, IIHR and also have worked at Malda, West Bengal in collaboration with Professor Jha. He claimed that, 250g of their proprietary material is equivalent to more than 1000 traps. Their study in India revealed that the product is effective in attracting insects even after four months of field application. At Malda, he has shown picture that even after heavy

rain the formulation did not wash away. He claimed that at Chittoor, AP this product has completely cured the fruit fly problem in Mango cv. Totapuri. They are looking into the possibility of implementing an area wide management for fruit fly in India. They have undertaken a systematic test in IIHR on Sitaphal and claimed to have achieved 96% control. They identified a female fruit fly attractant and bioassays will be conducted in future to test its effectiveness. Besides, compatibility of the attractant with the wax based formulation will also be tested.

Prof. H. K. Singh, Head of Dept., Entomology SASRD, Nagaland University have made a report on the fruit fly problems of Nagaland. He narrated that though no systematic survey on species diversity of fruit fly has been taken up in the region, the problem is very much there both in mango and cucurbitaceous vegetables. He expressed his eagerness to take up the training module developed by AAPP for farmers. He requested for an English version of the training material for them. He further expressed his eagerness to participate in North East specific fruit fly research.

Dr. Ivy Chakraborty reported that gamma-radiation facility in BCKV has recently been established with support from BARC. On experimental basis they have started post-harvest irradiation treatment of Laxmanbhog variety of mango. She has highlighted why fruit needs to be irradiated. She mentioned that till date she has developed a lot of experience in irradiation doses of fruits. On 24th June of 2016, Laxmanbhog mango was irradiated, and after irradiation the mango was stored in 10 °C. She found that for hot water treatment the skin of the fruit deteriorated after 1 month. But such deterioration was not found in case of irradiation trials. She pointed out that in case of irradiation treatment; insects were not killed immediately and died after few days. However, she stressed on availability of irradiation facility is a problem.

Dr. Arup Chattopadhyay, Professor and Office-in-Charge, AICRP on vegetables (BCKV Centre) highlighted the research conducted so far in BCKV on vegetable crop improvement. He mentioned that while West Bengal is the largest producer of cucurbi-

taceous vegetables, the productivity of cucurbitaceous crop in the state is low. He compared the productivity of different cucurbit crops in WB in comparison with the world and has highlighted the reasons of low productivity in WB. He has summarized the damage % of fruit fly in different cucurbit crops in different states of India. For example in muskmelon, 100% fruit loss was reported. He has summarized the available IPM technologies for fruit fly and impacts of these technologies. Finally, he highlighted some future research areas like, screening of germplasm against major biotic stresses and their utilization in resistant breeding programme. Integrated management of important diseases and insect-pests especially fruit fly by adopting sterile insect technique, transgene based embryo-specific lethality system, use of semiochemicals, and reinvasion by quarantine controls, in addition to the available local area management options, could be exploited for better results in wide area management of this menace in different cucurbits.

Ms. Paramita Bhowmik, SMS (Plant Protection), Malda KVK highlighted that at Malda district, farmers cannot differentiate symptoms of mango fruit borer and fruit fly. A recent survey conducted as part of the project on area wide management of fruit fly was conducted by AAPP at Malda with an objective to understand what species of fruit fly is attacking mango there and what control measure are to be adopted. They have used Methyl eugenol and ATGC wax formulations for monitoring and control of the pest. Surveys revealed that fruit fly infestation started during last week of Feb-March, in varieties like Amrapali, Himsagar, Rakhalbhog, etc. Further population was found to increase in July-August during Fajli mango. The study identified that farmers use chemicals indiscriminately. There is a general lack of knowledge about trapping for fruit fly. She pointed out that Malda KVK conducted farmers demonstration to make them aware about use of traps. She also pointed out that insecticide dealers do not like to sale the traps because these are cheaper than chemicals.

Ms. A. Rama Devi, PhD Research Scholar, Department of Agricultural Entomology, BCKV, gave a report from West Bengal (study conducted from

2014-2016) on fruit fly attack on guava and response of eighteen guava varieties against the pest, as was judged, on the basis of per cent fruit infestation, number of maggots per fruit and egg puncture counts throughout the fruiting period from the month of July to September. She reported severe infestation of summer guava by fruit fly (*B. dorsalis*) with maximum infestation recorded during mid-August to mid-September. So far, 18 guava varieties have been screened against this pest but none was found to be tolerant. Percent maggot density and egg puncture counts was maximum in the susceptible varieties like Sardar, Allahabad Safeda, China and Sweta, while significantly lower infestation was observed in moderately tolerant varieties (Mohammad Khaja and Baruiipur Local).

Prof. Hirak Chatterjee, Department of Plant Protection, Palli Siksha Bhavana (PSB), Visva-Bharati, Santiniketan, West Bengal and Prof. P.P. Dhar, In-Charge RRS, Sekhampur, Birbhum, BCKV, West Bengal, emphasized that fruit fly act as a major limiting factor for cucurbit growing in red lateritic tracts of West Bengal. They expressed their agreement on need of further region specific research on fruit fly and awareness development programmes amongst the farmers, field level officers, extension workers. He opined that there was deficit in enough training for the workers and also knowledge gap was affecting fruit fly research.

Mr. Koushik Sen, PhD Research Scholar, Department of Agricultural Entomology, BCKV reported that attack of *B. cucurbitae* start after fruit formation when these are tender and green and the incidence can be found until maturity of the crop throughout the season both at lower Gangetic alluvium and red lateritic zone of West Bengal. Pusa Do-Mausumivar was found to be highly susceptible (even up to 100 percent) and Contai bolder, a local cultivar performed much better, with less than 10 percent infestation.

Mr. Pranab Barma, Subject Matter Specialist (Plant Protection), Darjeeling, Krishi Vigyan Kendra made a report on fruit fly problem of mandarin orange in hills of Darjeeling. Since last two decades orange cultivation in this district is declining. According to a survey report conducted at Shittong, an adopted

village by Darjeeling Krishi Vigyan Kendra, it was found that orange cultivation had started to be abandoned and they were being shifted to large cardamom cultivation. Among the different problems of citrus dieback and fruit fly was the most important constraint to mandarin production. Growers were aware of this pest and had conflicting opinion on chemical control. Due to the attack, fruit drops occurred during September – October months. KVK conducted various training, demonstration and awareness programmes to combat fruit fly problem. Fruit fly was found not only a menacing problem of mandarin orange but also a major threat to vegetables growing in the district.

Abhishek Mukherjee, Assistant Professor, Indian Statistical Institute, Giridih Unit, Jharkhand through his presentation mentioned that several factors such as insect resource utilization pattern, developmental rate and spatial and temporal heterogeneity of environmental factors affect spatial pattern of insect population. Quantifying the spatio-temporal variability of insect population could lead to efficient deployment of site specific pest management which in turn could achieve better management of important insect pests. Frequent pest monitoring efforts could generate accurate information about insect population dynamics in a region. However, such an effort is costly and time consuming. Use of spatial statistical techniques to identify relatively homogeneous areas of insect population could be a cost effective alternative to optimize pest monitoring. Available in Arc-GIS, the Getis-Ord GI* Local Spatial Statistics approach identifies statistically significant population clusters and designates them as ‘hot spot’ (or ‘cold spot’) if a features and its neighbouring features have significantly high (or significantly low) population values. This approach has been widely used to identify insect population hot spots. He proposed to use

this approach to identify host spots of fruit fly population in Mango growing regions of West Bengal. The proposed approach could be an effective and environmentally friendly management strategy against mango fruit fly in West Bengal.

Following are the recommendations of the group meeting:

1. A comprehensive repository on fruit fly with collected species from Eastern and North-Eastern India need to be developed with support from ICAR-NBAIR and IIHR. ZSI, Kolkata can also extend support in this area.
2. Comprehensive training covering different aspects of fruit fly research need to be given to identified personnel/researchers in this zone. This may be done in IIHR/NBAIR like institute and also from suitable institutes from abroad.
3. Awareness day concept on fruit fly as has been developed by Association for Advancement in Plant Protection (AAPP) need to be promoted nationally.
4. SAUs need to take up study on fruit fly in their course curricula from UG to PG level with due emphasis.
5. The irradiation facility developed at BCKV need to be used as a regional resource for fruit fly related work. BARC can be approached to extend such support to North Eastern hilly zones.
6. Network project/programmes specific for Eastern and north-eastern India need to be funded by suitable funding agency for fruit fly mapping with reference to species diversity, host range, crop loss assessment, pest carry over especially in the hot spots which can be done using Getis-Ord GI* local spatial statistical approach, finding out ecological islands of Eastern and North-Eastern India, economically.