

***“BIOLOGICAL CONTROL IS THE MOTHER OF ALL
PLANT PROTECTION MEASURES”***

Tête-à-tête with Dr. T. M. MANJUNATH

**INDIAN ENTOMOLOGIST TOOK
PRIVILEGE IN INTERVIEWING SUCH
AN ILLUSTRIOUS ENTOMOLOGIST
AND A BIOCONTROL PIONEER
WHO IS HAILED AS THE ‘FATHER
OF COMMERCIAL BIOCONTROL
AND IPM IN INDIA’**

Dr. T. M. Manjunath is an illustrious Agricultural Entomologist with over five decades of research and executive experience, both in the public sector as well as in national and multi-national private organizations. Born on 11th June 1939 and brought up in Bengaluru, he was a student of Central College and obtained his B.Sc. degree from Mysore University in 1961. He started his career also in 1961 and later, while being in service, he opted for Agricultural sciences and obtained his M.Sc. degree in Agricultural Entomology from the Anand Campus of Gujarat Agricultural University and Ph.D. degree, also in Agricultural Entomology, from the G.K.V.K. campus of University of Agricultural Sciences, Bengaluru. During his long career, he served in four reputed organizations and had a diverse work culture, but he adjusted to it admirably, added his own and distinguished himself.

In the early part of his career at Commonwealth Institute of Biological Control (CIBC) and subsequently at University of Agricultural Sciences (UAS) -



Bangalore at its Regional Research Station, Mandya, Dr. Manjunath worked extensively on biological control of a variety of crop pests that included those of rice, sugarcane, cotton, maize, coconut, vegetable and fruit crops, weeds, etc. from different parts of India. He discovered and studied a large number of parasitoids and predators, over a hundred being new records, and contributed to laying a strong foundation for biological control and IPM. He is one of the pioneers in biological control in India. Subsequently, he worked on biopesticides, pheromones, integrated pest management (IPM), insect resistant transgenic *Bt*-cotton and other related areas. He initiated work in these areas at a time when these were barely explored, relentlessly tried to popularize them and made several pioneering contributions.

In 1981, Dr. Manjunath took a bold step. He resigned his job at the Agricultural

University and established 'Bio-Control Research Laboratories' (BCRL) of Pest Control India Ltd. at Bengaluru which is India's first-ever commercial insectary dedicated to mass-production and supply of biological control agents and pheromones. He developed innovative mass-production, packing, pricing, marketing and application techniques for several promising biocontrol agents which included *Trichogramma*, *Bracon*, *Goniozus*, *Spalangia*, *Chrysoperla*, *Cryptolaemus*, *Chilocorus*, *Nephus* and Nuclear Polyhedrosis Viruses (NPVs). A semi-automatic *Corcyra* production technology developed by him turned out to be a game changer in mass-production. He designed a new Pheromone Funnel Trap which became quite popular. He has put in enormous efforts to popularize these products among farmers. Never before these were produced, marketed and adopted on such a large scale throughout India and it created a huge demand which paved the way for emergence of a new biopesticide industry, starting from the mid-1980s. In recognition of his pioneering contribution, the biopesticide industry has hailed Dr Manjunath as the 'Father of Commercial Biocontrol and IPM in India'.

Another significant contribution that came from Dr. Manjunath was when he served as one of the key members of the Monsanto-Mahyco team that was responsible for regulatory approval of *Bt*-cotton in India in 2002. *Bt*-cotton is the first-ever GM crop cultivated in India and he is one of those who strived for its scientific outreach and successful adoption, It was a breakthrough in cotton bollworm management and a turning point in Agricultural biotechnology.

He is an author of over 130 research papers and six books. He has delivered innumerable

lectures, including many keynote addresses, at national and international symposia as well as at schools, colleges and farmers fora in India and other countries. Throughout his career, Dr. Manjunath has maintained close contacts with academic institutions, research organizations, private sectors, farmers and other stakeholders. He continues to do so even now.

Dr. Manjunath has served and continues to serve in several Expert Committees constituted by FAO (*Food & Agriculture Organization*), WHO (*World Health Organization*), ICAR (Indian Council of Agricultural Research), DBT (Dept. of Bio-Technology), Govt. of Karnataka, various universities and other organizations, focusing on issues related to policies and research. His expertise was also utilized in China, Nepal, Portugal, Sri Lanka and other countries for developing their technical programs on biological control and IPM. He recently (2019/20) set up a biological control laboratory for United Phosphorus Ltd. (UPL) at their premises at Vapi in Gujarat (India).

Dr. Manjunath has received several awards/honours in recognition of his 'Commendable Lifetime Contribution to Biological Control and IPM'. These were received from: Plant Protection Association of India (1994); Institution of Agricultural Technologists & UAS-Bengaluru (1995); National Academy of Agricultural Sciences & Indian Agricultural Research Institute (2015); Society for Biocontrol Advancement (2017); World Bio Protection Forum (2019); T.B. Fletcher Award from Dr. B. Vasantharaj David Foundation (2020); 'Outstanding Alumni Award' from the Alumni Associations of UAS-Bangalore (2015), Gujarat Agricultural University



(2018) and Mysore University (2020). He has also received 'Manager of the Year' award in 1990 and 'Excellent Performance Award in Research and Business' in 1993 from Pest Control (India) Ltd. for the services rendered at BCRL. In 2002, he received 'Special Recognition' from the CEO, Monsanto Company, USA, for his contribution towards successful Introduction and Stewardship of *Bt*-cotton in India as one of the key members of the team.

He is a Fellow of the Entomological Society of India, a Fellow of Plant Protection Association of India, a founding member and past president of Entomology Academy of India, a founding member of Society for Biocontrol Advancement, and a founding life member/past officer bearer of several other professional societies. Throughout his career, Dr. Manjunath has shown an unusual zeal to venture into novel or under-explored areas of pest management that have greater practical relevance and championed the cause of integrated pest management. His colleagues and friends consider him as an exemplary combination of scientist & administrator, an unforgettable motivator

and a guide, a perfectionist, and an outstanding communicator who can adapt and reach out to audiences at any level. At 82, Dr. Manjunath continues to be as committed and active as ever, He says "I am retired, but not tired."

Dr. Kolla Sreedevi, Associate Editor of IE, interacted with Dr. T. M. Manjunath and the excerpts of the discourse are presented below. Some of his 'Words of Wisdom' are highlighted in italics and blue.

Dr. K. Sreedevi (KS): You started your career in biological control way back in 1961. What was its status then?

Dr. T. M. Manjunath (TMM): I started my career at the Indian Station of Commonwealth Institute of Biological Control (CIBC), one of the major units of Commonwealth Agricultural Bureau (CAB, London), in 1961. Its Indian headquarters was located at Bengaluru (then Bangalore) in the same premises as that of the present NBAIR and its functional research stations were spread across the country depending upon the crops/research projects. Biological control was barely known at that time. In the

1960s, Govt. of India was aggressively promoting family planning and it was a buzzword then. Looking at the sign board displayed on the compound facing the main road (Bellary Road), most people used to mistake it as 'Commonwealth Institute of Birth Control.' Some others thought that it is an institute meant to deal with *wealth* related to *common* financial issues (common wealth).

KS: What did you work on in the initial years of your career?

TMM: Since biological control of crop pests and weeds was almost an unexplored area, CIBC submitted several interesting projects on major crops and was able to get funds mostly from the US PL-480 scheme. Those projects included exploratory surveys for natural enemies, studying their bio-ecology, evaluation of their efficacy, developing techniques for culturing them and several other aspects related to biological control. I had the opportunity to work, often concurrently, on several such projects from different parts of India (Bengaluru, Guwahati, Shillong, Jorhat, Bhubaneswar, Dehra Dun, Anand, Andaman, Lakshadweep, etc.) dealing with pests of rice, sugarcane, cotton, maize, coconut, vegetable crops, tea, forest trees and other crops as well as aquatic and terrestrial weeds.

KS: Was it not very demanding to work on several projects at the same time? What was your experience?

TMM: In CIBC, the work culture was different. Since we were dealing with live insect cultures, officially the working days included all the seven days in a week, with Saturday, Sunday and all general holidays being half-day. We used to spend more than

half-a-day almost daily in fields, making large collections of insect pests for discovering and studying their natural enemies. A wealth of information on several crops/pests came out from such pioneering efforts from different parts of India and CIBC established a distinct niche for itself not only in India but also it put India on the global map of biological control. Thus, CIBC laid a strong systematic foundation for biological control in India. Indian Council of Agricultural Research (ICAR), Indian Agricultural Research Institute (IARI), Directorate of Plant Protection, Quarantine and Storage (DPPQ&S), Agricultural Universities, etc. further strengthened biological control. I was fortunate to have been associated with this technology right from such an early phase and exposed to its various facets which gave me an opportunity to learn and contribute to its growth. I thoroughly enjoyed my work. Even now, after nearly 60 years, biological control continues to be my first love.

KS: In your view, what are the most significant aspects of biological control?

TMM: I strongly hold the view that *biological control is the 'Mother of all Plant Protection Measures'* considering that more than 95% of herbivores are kept under perpetual check by the action of their natural enemies. Such silent contribution is seldom realized and appreciated. It is only when certain insects escape the impact of such natural control due to various factors, they become major pests and attract our attention. Then we intervene and try to restore the balance in favour of natural enemies by conservation, augmentation or introduction, or by taking any other control measures. Another significant aspect of biological control is the outstanding successes obtained with the control of several notorious pests

and weeds through classical biological control. It may be rare, but when successful, it is highly sustainable and incomparable.

KS: What made you to leave CIBC and how did your career progress further?

TMM: Most of us had to leave CIBC as, with the closure of PL-480 and other



T. M. Manjunath at the CIBC lab, 1963

projects, it was facing an uncertain future. At that time, I joined University of Agricultural Sciences, Bangalore, in 1976 and was posted at its Regional Research Station (RRS) at V.C. Farm, Mandya, to work on All India Coordinated Research Project on Rice under ICAR. Besides working on the prescribed experiments which included screening of rice cultivars and insecticides under this scheme, I also worked on sugarcane, ragi (pearl millet), coconut, etc. In fact, I established a laboratory at RRS for production of parasitoids for control of coconut black-headed caterpillar which had become a serious pest in several parts of Karnataka. I was quite happy working in the university and enjoyed the campus life.

KS: You were the first one to establish a commercial biocontrol insectary in India. How did it happen?

TMM: While I was working in the university, Pest Control (India) Limited approached me repeatedly to join them and establish a commercial biocontrol unit. Initially I was hesitant, but finally accepted the offer, resigned my job at the UAS-B, and established 'Bio-Control Research Laboratories' (BCRL) at Bangalore in 1981 which is India's first ever commercial insectary dedicated to commercial production and supply of selected biological control agents.

KS: What were the challenges faced in managing a commercial insectary?

TMM: First of all, I had to start everything from the scratch! Production, packaging, pricing, dosage, brand names, marketing – everything was a new experience. For the *Trichogramma* cards produced at BCRL, I gave the brand name 'Tricho Card' which is now used by most people as a common name! *I would rate mass-production and marketing as the toughest challenges in biocontrol.*

KS: What were the problems encountered in mass-production?

TMM: Mass production of the required quantities of parasitoids and predators, their timely supplies and releases are very challenging and filled with tension. Generally, when the lab production is at its peak, there is no adequate demand and when there is high demand, the production declines. *It is a huge challenge to match the production and demand.*

The paradox is that the pest insects, be it *Helicoverpa*, pink bollworm, *Spodoptera*, mealybugs, scale insects or any other, which multiply so rapidly in fields and cause serious crop losses in spite of our taking various control measures, refuse to multiply

similarly in the laboratories even if we provide and pamper them with all the comforts and nutritious diets. In a biocontrol insectary, 80-90% of our efforts go towards mass production of host insects (i.e., pests) rather than parasitoids or predators. Another frustrating experience is related to *Corcyra*. While we are mass producing *Corcyra* to be used as a factitious host and when the production is at its peak, its larval parasitoid, *Bracon hebetor*, somehow manages to enter the culture rooms and bring about its complete control in 3 to 4 weeks, thereby upsetting all the production plans. This is an embarrassing example of a successful biological control taking place at a wrong place! This also shows that insects have their own mind and are adamant. *Insects multiply only where they want to multiply and when they want to multiply, not where and when we want them to! It is a huge challenge to alter it.* Thus, commercial production is beset with numerous challenges which have to be managed with preparedness. I was able to manage and make BCRL a commercially viable unit for 16 years from 1981 to 1997 with only a minimum, but highly committed staff. *Skilled workers are the backbone of a commercial insectary.* Besides parasitoids and predators, we were also producing NPVs as well as pheromone traps and lures. These not only supplemented business, but also helped in promoting integrated pest management. *I have experienced the stress and success, or the tensions and thrills of commercial production.*

KS: Was not marketing these products a big challenge?

TMM: Marketing was/is truly challenging, especially at a time when the plant protection domain was/is dominated by

chemical pesticides. Further, since parasitoids and predators are live insects with definite life cycles and shelf-life, these cannot be mass-produced in advance and stored for a long time, It is safer to produce these against confirmed advance orders. In other words, *the products are to be sold even before they are produced!* It is easier said than done. Sudden cancellation of confirmed orders would be a bane, resulting in financial loss as well as precious biocontrol agents. Another challenge is to make the farmers understand the value of each biocontrol agent and how it works. Thus, *the products are to be sold along with the technology.* This calls for great communication skills. Nevertheless, following our untiring efforts, many progressive farmers from all over India became our customers, especially sugarcane, grape, cotton and coconut growers. I used to meet and interact with them personally to explain and convince them. Creating awareness and on-farm demonstrations are the key drivers.

A major turning point came when the Directorate of PPQ&S, Govt. of India, gave funds to various state governments to purchase biocontrol agents and pheromones and provide these to farmers at a highly subsidized rate for direct field applications in an attempt to promote IPM. This created a huge demand and assured market. Initially, BCRL was the only dependable supplier, but gradually it paved the way for emergence of a new biopesticide industry. Never before these were produced, marketed and adopted on such a large scale in India. BCRL played a pioneering and crucial role in this endeavour.

KS: Recently, the biopesticide industry hailed you as the 'Father of Commercial

Biocontrol and IPM in India.’ How did you feel about it?

TMM: It is most gratifying and I am very thankful to them. A few of the youngsters who came in contact with me in the mid-

"Mass-production and marketing are the toughest challenges in biocontrol"

1980, forayed into biopesticides and pheromones, being inspired by BCRL. They are now major players in the industry and doing very well. I admire their commitment and perseverance. I wish someone takes up the production of macrobials as well.

KS: Why there are not many commercial producers of microbial biocontrol agents?

TMM: As explained, it is a very tough job filled with tension at every stage and unless one has a passion for it, it may not be attractive. *Commercial biocontrol insectary should be treated as a passionate scientific adventure rather than a mere business venture.* After nurturing for 16 years, I left BCRL in 1998 to move on with my career, but was thoroughly disappointed that the production of parasitoids and predators was discontinued there after a year or so.

KS: What prompted you to leave BCRL later?

TMM; Monsanto, the USA-based largest agricultural biotechnology company, wanted to establish a research centre in India at Bengaluru. It was a big news, especially as they wanted to initiate research on agricultural biotechnology including *Bt*-cotton. One day, most unexpectedly, they approached me to join them. My immediate

response was ‘no’ as I was emotionally attached with BCRL. But they persisted and came up with a very attractive offer which I finally accepted. I joined Monsanto in 1998 and was involved in establishing their Monsanto Research Centre at Bengaluru. It gave me an opportunity to work on agricultural biotechnology in general and *Bt* cotton in particular. It was another new opportunity for me to learn and contribute.

KS: The introduction of Bt cotton met with a lot of opposition. What are your views on such opposition and the technology itself?

TMM: History has shown that whenever any new technology or product is introduced, be it *Bt*-cotton or any other, it always faced opposition by a section of the people. They are specialized in criticizing and protesting. However, *Bt*-cotton has proved beyond doubt that this technology is safe, effective against bollworm control and advantageous to farmers. The fact that presently more than 95% of the total cotton area in India is occupied by *Bt* cotton, being cultivated by over seven million farmers, is a testimony to its merit. It gave us a lot of satisfaction.

KS: Do you think biotechnology has a major role to play in agriculture and in what way it can benefit biological control?

TMM: Yes, *biotechnology has the potential to find solutions to several biotic and abiotic stresses* which might be beyond the reach of other technologies. It does not mean that it is a silver bullet for all problems. We need to exploit other options as well.

Transgenic *Bt*-cotton technology has already proved that it can very effectively control cotton bollworms and drastically bring down the application of chemical insecticides

“There should be two levels of research goals: long term goals for the institutions while short term goals for individuals”

thereby help conserve natural enemies. This technology is compatible with all other plant protection measures and can serve as a major component of IPM. *Biotechnology can also be exploited to enhance the quality traits of biological control agents.*

KS: You are one of those who, along with biological control, championed the cause of Integrated Pest Management (IPM) right from the 1960s and 1970s. What are your views on IPM?

TMM: IPM is the most sensible and practical approach. We must realize that every technology was relevant to that particular period and had its own impact. No technology should be over-used or abused. *No matter how powerful a technology is, it cannot solve all the problems and also it cannot last forever.* The problems do not remain the same and, therefore, research is a dynamic area. Every technology, be it traditional or modern, has its own merit as well as limitations and we should try to exploit it depending upon its suitability to a given situation. The most prudent approach is to take advantage of each technology wherever suitable and integrate it with other technologies so as to solve a problem and get maximum benefit. This is the broad philosophy of IPM. I have always emphasized that *Integrated Pest Management is nothing but ‘Intelligent Pest Management’*, the acronym (i.e., IPM) remaining the same.

IPM is not biased towards any particular technology. On the other hand, it is all

inclusive, be it cultural, mechanical, biological, chemical, GM technology or whatever.

KS: There are certain lobbies which are strongly opposed to the use of chemicals, genetic modification technologies, etc. What is your view on this?

TMM: There is no need for us to worship or decry a technology just because it is traditional or just because it is modern. Our choice should be based on its suitability to a given situation. Those who believe in any particular approach, may follow it if it is beneficial to them. But, there is no need to form a separate lobby for chemicals, biologicals, GMOs, organics, etc. and condemn or boycott other technologies. It would tantamount to creating a ‘caste system’ in science. *There is scope for ‘secularism’ or ‘co-existence of all technologies’ in science also* as recommended in IPM, with major focus being on environmental safety.

KS: You have worked both in the public as well as private sectors. May we know the major difference between the two?

TMM: They are entirely different and both are important. The public research institutions mostly concentrate on basic research and try to publish their findings as early as possible. It is more of academic and publication-oriented. On the other hand, in private sector, the research is more ‘product-oriented’ and their emphasis is on patenting, production, practicality and business rather than on publishing. If there is mutual understanding and cooperation between the two sectors leading to Public Private Partnership, it would be a win-win situation for both.

KS: Your suggestions for the younger generation and future research?

TMM: There seems to be a lot of duplication of research programs in various public institutions. This can be avoided. I feel that *there should be two levels of research goals: long term goals for the institutions while short term goals for individuals*. Long term goals should tackle more difficult problems which may take several years to accomplish. It should be a team effort and ensure continuity of work even if certain members of the team move out. Another suggestion is that the *scientists of younger generation, who are no doubt very talented, should be challenged to come out of the 'comfort zone'* and try to do research on seemingly difficult areas so as to exploit their full potential. It will be more useful if they concentrate on research that has more practical relevance. It should be realized that however strong a lock may be, it has to have a key to be useful! Similarly, however tough a challenge may be, the skill lies in finding a solution with commitment and perseverance.

KS: Can we get an insight into your other activities beyond research and the most favourite activity/stress busters?

TMM: I am deeply interested and involved in social, educational and cultural activities. I have been a member and a Melvin Jones Fellow (MJF) of Lions Clubs International since 1981 and participating in various community service activities. I am one of the donors and the Managing Trustee of 'Krishi Vidya Nirantara' (KVN), an educational trust that provides financial assistance to deserving students of agriculture. I am the Chief Patron of 'Drishti Art Centre' at Bengaluru which is dedicated to promote Bharatanatyam and other classical arts. Besides, I have always been interested in theatre. I have acted in more than 50 dramas and authored myself four Kannada plays. I love watching cricket

matches, films and a few selected TV programs. I watch almost daily for about 30 mts. videos of songs from Hindi, Kannada, Tamil or Telugu movies before going to bed. In other words, I am interested in almost everything!

KS: Before we wrap up, please tell us what were the most exciting or satisfying parts of your career?

TMM: One of the most exciting parts was that I had an opportunity to work on biological control, biopesticides, pheromones, integrated pest management, insect resistant transgenic *Bt* cotton, etc. when these areas were barely explored and that I was able to learn and make some significant contributions during their growth phase, leading to increased adoption. In fact, I have grown along with these technologies. Another satisfying aspect was that whether it was PCI or Monsanto, I did not apply for a job. They approached and offered me the coveted jobs on their own which I consider as a great recognition. Similarly, I received several lifetime achievement awards. I did not apply for any of them. It gives me a great deal of satisfaction. Yet another satisfying aspect was that wherever I worked, be it CIBC, UAS-B, BCRL or Monsanto, I was very well looked after and I thoroughly enjoyed my work. Above all, I was truly blessed to have started my career at CIBC under such an inspiring and a stalwart like Dr. V. P. Rao whom I consider as my role model followed by Dr. T. Sankaran. Similarly, Mr. N. S. Rao and later Mr. Anil S. Rao of PCI were very understanding and encouraging for starting and managing BCRL. I had wonderful colleagues in all the organizations who have become lifelong friends. We continue to be in touch even now. There has not been a single day, while in service or later, when I

felt bored or tired of working. I am as enthusiastic as ever. As I generally say “I am retired, but not tired.”

Concluding remarks by KS:

It was a sheer delight and privilege interviewing a legend like Dr. T. M. Manjunath. It was an enriching experience listening to his rich and decades of varied experiences interspersed with interesting anecdotes. There are several ‘**Quotable Quotes**’ or ‘**Words of Wisdom**’ expressed by him on biological control, commercial insectary, mass-production and marketing, integrated pest management, biotechnology and *Bt*-cotton, institutional and individual goals, need to come out of comfort zone, secularism in science and various other aspects related to plant protection as well as his multifaceted interests beyond science. One can learn a lot from these. For me, it is a memorable experience which I am going to cherish for a long time.



The interview is conducted by Dr. Kolla Sreedevi. She is working as Pr. Scientist at Division of Germplasm Collection and Characterisation, ICAR- NBAIR, Bengaluru. She is working in the field of Insect Biodiversity and Systematics especially Scarabaeidae and Cerambycidae (Coleoptera); Insect Ecology, biogeography, molecular characterization. She is also an Associate Editor of IE.

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