



Short Article

Medical Entomologists - A Disappearing Profession in Public Health System: Indian Perspective

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As a biologist and a non-medical epidemiologist, it has now become necessary to talk about the plight of the present day entomologists. Without entomologists, malaria, or for that matter any vector-borne disease would never have been controlled anywhere else in the world, including India. Unfortunately, their important role in public health is being downgraded and even ignored these days. Ross, Soper, Hackett, Russel and several others were medical men, but who took great interest in mosquitoes and had contributed a lot to malaria control. An engineer Ronald Senior White wrote many papers on mosquitoes, and two eminent medical men Barraud and Christophers, wrote books on mosquitoes for the fauna of British India.

Soon after Independence in 1947, people from the South used to flock to North Indian Universities like BHU, Lucknow, and Allahabad for post-graduation in Zoology. I was also one of them. There was no Post Graduation in Entomology anywhere in India at that time, leave alone Medical Entomology. Due to the PhD specialisation of the Heads of Departments in these Universities, these universities offered MSc specialisations in their subjects. If I remember right, Allahabad offered Fisheries and Lucknow Offered Mallophaga. Likewise, BHU offered Entomology as a special subject. So I joined BHU, but the entomology is "Structural". We had to study the Text Book of AD Imms - All morphology of insects. Nothing about diseases transmitted by insects. As part of general Zoology, some general mention about some vector transmitted diseases was made. The only insect-transmitted disease, malaria, which was a raging annual epidemic every year, was also taught only casually. No other vector-borne disease like filariasis, Scrub Typhus, etc was ever taught. We, the students, mugged up whatever was delivered by our professors at that time. Take the case of malaria. The exo-erythrocytic cycle of malaria, though discovered in 1945, was not taught, though I took my MSc in 1952! What I mean to say is that it was all bookish knowledge or the contents of the notebooks of our professors who taught. We all studied so that we could get a degree which enabled us to get a job! We all learnt about malaria and vector-borne diseases, and even the classification of different vector mosquitoes, we learnt



as part of the new jobs we had undertaken. I had the good fortune to join the Rockefeller Foundation (RF) run Virus Research Centre at Poona, where I learnt about mosquitoes, diseases etc.

It was in 1958 or so, the National Malaria Control Organization was set up in Delhi, with Dr AP Ray as Director. He did a tremendous job, thanks to the use of DDT as indoor residual sprays. The coverage of villages in India was almost 100%. One should read the story of malaria control in India in those days, to realise how important a role the entomologists played. They toiled hard in the field. There was a drastic reduction in malaria and then the eradication era started in the sixties. The NMCP became NMEP. The top bosses thought that DDT can replace entomologists, and slowly and steadily they were neglected. Then started the doom. Slowly mosquitoes developed resistance to available insecticides; they showed behavioural changes in their resting, biting and breeding behaviour. These could have been measured only by the entomologists, but then they had been shunted out.

The big resurgence of malaria happened. It was too late. Meetings were held, and it was realised, though too late, that you cannot control malaria without entomologists; rather any vector-borne diseases. They are too many to be enumerated: filariasis, Scrub Typhus, dengue, chikungunya, KFD, etc.

During the past few decades, no important research has resulted in finding new solutions to the control of any vector-borne disease like malaria. There are over 1.5 million cases now (2020) with thousands dying of malaria, according to a recent report issued by the Parliamentary Consultative Committee on Health. There were several thousand deaths and a few hundred in Bombay City alone. In tribal areas, infant and maternal mortality due to malaria is about 80% even now. Gone are the days when the malaria situation was tackled on a war footing under Dr BA Rao and Dr AP Ray. With the success of DDT in controlling malaria, a euphoria was created which led to the ultimate destruction of the entomological cadre. During the early part of the last century, many medical scientists (e.g. Christopher, Barraud, Mulligan, Sinton and Short, Russell and Senior White) worked extensively in the field and wrote even books and papers on mosquitoes. The Malaria Institute of India became the National Centre for Disease control. Malaria control at the national level became an operational programme, with the belief - SPRAY AND PRAY! Soon the mosquitoes developed resistance to insecticides like DDT because of lacunae in the control operations. Had there been constant entomological surveillance and research, it would have been possible to find a solution to this serious problem. But there were no entomologists. Failure of

the control operations was sought to be covered under the cloak of "resistance". I know in Orissa, the Medical officers said all malaria deaths are due to "starvation" and the Revenue people dubbed them as deaths due to malaria. In some remote villages under the Borigumma PHC (Koraput Dt), no malaria people or doctors had visited them for years. Other diseases like dengue had also come in a big way, often obscuring the diagnosis of malaria! Many research organizations were there in India like ICMR and NCDC. Separate control Organisations like NVBDCP (now NCVBDC) - successors to NMCP and NMEP also came. Instead of operational research in the field, the research organisations started Molecular Research. Fieldwork gave way to laboratory work in air-conditioned rooms. New educational courses were started to produce Medical Entomologists. But those who passed out were not getting jobs, and those getting jobs are absorbed in non-vector control activities.

Because of the COVID-19 pandemic, no more attention was paid any more on malaria. The priorities are different now because dengue epidemics are now occurring with regular frequency in many places. As Wilbur Downs had said, dengue has in the past also overshadowed malaria, and many malaria cases are diagnosed as dengue. But then there are no more entomologists these days, who used to slog in the field looking for mosquitoes and study their vectorial status. The existing entomologists are now molecular scientists, sitting in air-conditioned laboratories with computers. The present-day research on malaria is all about getting foreign funding for new research projects (euphemistically called sponsored research), trying to find out new drugs, new insecticides etc but nothing was being done to improve operational efficiency - the less said about it, the better. Current day research on vector biology and control is all on paper. Go on publishing more and more papers - of course, it must have an impact factor - it does not matter whether your research has contributed towards disease control or not. It was only a blame game all around. Millions of dollars of aid have been given by several philanthropic organisations like World Bank, Bill Gates foundation, etc. What is the result? We are perpetually publishing papers, with a high impact factor (?) more to enhance one's career, than to solve problems in the field! There is no accountability. There is no adventure or curiosity in trying to find the solution to our problems. We are perpetually carrying out 'research' mostly funded by foreign organisations and universities. Who has studied the work of people like Dr Lewis Hackett (his work on malaria control in Czarist Russia) and his stories on malaria control during the Spanish American War in the Philippines, Fred Soper's work in Panama Canal Zone and Brazil, Paul Russel's work in India (Pattukkottai)? How many of our present-day

scientists in ICMR have read the autobiography of the great, late Dr CG Pandit titled “My experiment with preventive medicine”? He was the first Director-General of ICMR, who interacted with and inspired and encouraged many young scientists like me during the fifties!

Of course, the WHO had always been very liberal with their advice. They have given us many slogans or jargons like “Health for all by 2000; malaria control through ‘Primary Health Care’ etc. The WHO works by consensus. Their expert advice is never practical, but they have their own compulsions. They have to obey the dictates of the donor countries and Nature once wrote that they are the salesmen for multinational companies. But in India, we have given a lot of undue respect to them because of their money power. The WHO jobs and consultancies, etc, are very lucrative. Many present-day officials and scientists are after them.

The present thrust of biomedical research in our country is on molecular biology, hybridoma technology and biotechnology or any other trash which contains these magic words. The late Dr Wilbur Downs, who was a famous malariologist and virologist under the Rockefeller Foundation, was very critical when he said, “Projects relating” to new drugs, enhancement of immunity by vaccine, genetic studies of parasites, host and vectors, new insecticides etc have gone on apace. Their studies are fascinating; they are the new scientific approach. But they are also illusory. They deflect the attention from here and now. The “here and now” is that today there are millions of villagers for whom the application of knowledge and means already at hand an adequate supply of anti-malaria drugs, simple control procedure carried out on the local problem... is still awaited. Yesterday came and went, today comes and goes. Tomorrow will come and go. Malaria remains unshaken”. The WHO closed down the division of vector biology and control in the eighties, and renamed the department molecular entomology. Our government also promptly shifted the emphasis to molecular biology. Almost all the universities also converted their departments of zoology/ entomology into departments of life sciences or biotechnology. Now, two of the ICMR institutions have been asked to start MSc courses in medical entomology. Assuming that these two institutions, really start running the course, there is, of course, no guarantee that those completing these courses, will find employment since all organisations like ICMR, CSIR, UPSC, Health ministry etc have not initiated steps to declare MSc in Medical Entomology as an essential qualification for recruitment. Also, where are the people who will teach the subject? Nearly 90% of our present-day scientists are computer specialists. Let us now look into at least the new diseases, emerging, neglected etc. There are many diseases which come into this category. What in my opinion, should be done is to carry out ecosystem studies on these new and emerging diseases about which

very little is known, but the present-day authorities do not care. In the past, both the VCRC and the VRC (now NIV) had undertaken long term studies on several diseases, like JE, KFD, malaria, filariasis etc. Above all, a cadre of young scientists, basically field-oriented, has to be created. But who wants these studies now? One has to toil hard in the field and yet is ignored. Catchy phrases and foreign collaboration have become a mandatory requirement, to a ridiculous extent, to get funding in the priority areas in biomedical research. All scientific workers, mainly those who come back to India after completing their higher studies abroad, want to work in air-conditioned laboratories, with expensive imported equipment. They also try to publish papers, irrespective of their importance in helping to solve public health problems in India.

I sincerely feel that our scientists should break new paths now and move away from the present state of inefficiency. They must search out for problems affecting mankind and think about solutions. Scientific curiosity should be there to break new ground. “Science cannot be quantified by the number of papers published. Don’t waste time duplicating material or doing pedestrian work. You may as well feed data (mostly junk) to a computer and bang comes a paper. You go into science to solve problems, not to find the ingredient of success”, so said Dr R Venkataraman, Nobel laureate. He also said that India should work on the development of a culture that would aid in promoting more cutting edge research in science, and thus would help in producing role models. He believed that the presence of a number of role models is the reason for Indian scientists performing so well outside India. They meet scientists doing a lot of focused work and engaged in front line research.

I would like to suggest to my younger entomological colleagues in RMRC, VCRC, NIMR and NIV and other Centers that they should go to the field, and adopt an ecological approach to research vector-borne communicable diseases. Though there are many problems, I can give only a few examples to which they should pay some attention. Pavlovski propounded the theory of natural nidity of infectious diseases. Many diseases, particularly of zoonotic origin, can be found in nature, existing independently of man as well as his domestic animals. This is an example of an ecological peculiarity in which the association of pathogen with the natural host is often through an intermediate vector. Soil vegetation, climate and topology (landscape epidemiology) constitute the various environmental factors that determine this association. With the help of these factors, some diseases can be reliably predicted, for instance, harbour tick-borne diseases like KFD and RSSE can be found in mountainous areas, grasslands, forests, and agricultural lands; Cutaneous leishmaniasis may be found at the edge of deserts etc. Such places, commonly called “silent zones of diseases” will only be brought to light when

a susceptible human gets infected by direct or indirect contact with them. Similar other places may be found with proper ecological awareness and precise knowledge. Ecological methods have been applied to extensive study of arthropod-borne encephalitis which revealed that birds serve as natural hosts and mosquitoes as vectors. In WEE, man and horses are dead-end hosts. In JE, man is the dead-end host. Small animals and birds were considered possible (and over-wintering) reservoirs. A few mammals such as pigs and cattle in the case of JE may increase the virus population. One should consider the similarity in the ecology of WEE, MVE, WN and even JE where the existence of mosquito transmission and birds as natural hosts has been established. A clear understanding of the epidemiology of other arboviruses like yellow fever and KFD has become possible owing to their ecological studies and it has been concluded that monkeys hold a key position in both. Though in 1931, a sylvatic cycle with *Aedes albopictus* as vector and monkeys as sylvatic hosts was considered in the case of dengue, it is not yet sure whether a cycle that does not involve man exists. Dengue occurs in regions where *Aedes aegypti* is found, like the tropical and sub-tropical regions and warm temperate zones. The urbanisation of new variants of dengue viruses, which were earlier found in some sylvatic reservoirs has been suggested. Dengue was always endemic in the presence of *Aedes aegypti*. In spite of numerous studies, it is not yet clear whether the occurrence of the epidemic was governed by vector density and extrinsic incubation. *Aedes aegypti* is found in the coastal region of Malaysia and *Aedes albopictus* is found in the interior. Dengue antibodies have been found in monkey sera. However, dengue has been found to be endemic in places which do not have monkeys, thus a possibility is considered that different mammals may be important in different regions of the world.

Aedes aegypti and *Aedes albopictus* are also considered to be vectors in the case of Chikungunya, which presents with high fever with polyarthrititis. A strain of this virus was isolated from *Aedes africanus* caught in the Zika forest. This has given rise to the possibility of a sylvatic cycle other than man/ *Aedes albopictus*/ *Aedes aegypti* cycle. Similar sylvatic cycles may be possible in the case of Chikungunya and haemorrhagic dengue. The occurrence of Chikungunya cases in Tamil Nadu was recently reported but needs confirmation. The role of small rodents and shrews is suggested in such an enzootic cycle owing to their large population. A rodent-mite-rodent chain involving non-mosquito vectors such as gamasid and laelaptid mites has also been thought of. Chikungunya can prove to be a public health hazard in the coming time and hence demands extensive research. Scrub typhus is another emerging disease of concern, with numerous cases reported in India recently. Its vector is Trombiculid mite. It was the main area

of study of The Founder Director of the Institute of Medical Research in Kuala Lumpur, Dr JR Audy.

I had served the ICMR for nearly 40 years during which time I had the opportunity of working with many world-renowned scientists. I had learnt many subjects the hard way by working in the field and in communion with nature. The initial training with experts of Rockefeller Foundation with whom I had worked from 1953 to 1970, was a real experience. I was never discriminated against or harassed because I was a non-medical Entomologist, as is happening even now at the national level in malaria and other vector-borne disease control programmes. I am quoting below, verbatim, the comments of four distinguished scientists, all superannuated, and above 70 years old and mine also (90+), and who had spent their lifetime in Science, won laurels, etc. These comments are worth reading for any student of Medical Entomology. When I was working under Dr T Ramachandra Rao, in the 1950s, he had told me, "In India, Entomologists are like the free gift of Curry leaves and Coriander leaves, after you buy vegetables. They are treated cheap". How true it is in 2022, even seven decades later.

See the views of these scientists who have now retired from service.

Prof Dr SNS (2022): "In the present era, field entomology has become the mosquito collection and house to house search by ASHAs and MPHWS and the qualified entomologists have become typists and data entry operators. Where is the real field entomology these days and who bothers about it in any public health programs? Medical Entomology is not a priority at all in public health programmes and the poor postgraduates with PhD degrees have become leverage on contract basis with no future ahead. Unfortunately, the epidemiologists are criticising the field of entomology which has remained confined to mosquito/ vector collection and not able to correlate with the diseases in terms of the vector carrying the pathogen/ viruses. I am sorry to say that the entomologists have never been given the opportunity to establish a medical entomology laboratory with Good Practices Protocols..... The state or district entomologists do not understand the concept of arthropod containment... and they do not have any set up for even."

Dr PKR (2022): "The medical, non-medical bias. The Government itself is responsible, because they have ruled this. Example, (i) The great Dr TR Rao DSc could never head the malaria control set up in old Bombay State, because he did not have an MBBS degree. First of all please remember there are exceptions, and there are brilliant non-medical men as well as medical men who have excelled. (ii) The entomological curricula in Universities in India, have always been archaic, never problem-oriented, and routine textbook-oriented. (iii) In Medical Entomology itself, none of the universities ever taught the classic works of Fred

Soper, KF Meyer, Paul Russel, Lewis Hacket, etc. (iv) The entomologists have never been entrusted with leadership roles, and even the good papers written by them are with their medical bosses as senior authors who had never visited the field. (v) There are gross disparities in their salaries for equal positions because the medicals get a non-practising allowance for what? Only people who can't get post-graduate seats in medicine and surgery, go into the research stream. They join the Central Health service. Future promotions are based on seniority in service and not on Merit. (vi) Take Malaria control. What did the medicals do? Most of the work is in the field, and only entomologists did all fieldwork, and they are rarely given full credit. There are, of course, exceptions to the rules."

Prof BR Sant (2022): "I am perhaps the only layman amongst you all, a dozen Indian experts in Entomology. I have a couple of suggestions: The subject mentioned in these e-mail exchanges is given as "poor plight of entomology in India". It is too mild to attract the attention of an iconic and globally important branch of knowledge among specialists and generalists, and the public. Secondly, your audience has to include IPs if not VIPs of Biology/ Biotechnology who can influence science policies of India. They need to be dominantly associated with Academies/ Associations of repute like INSA (Indian National Science Academy) so that the "issue" sails along with academies and their important members to reach the corridors of power. Third, the "issue" needs to come close to the ears of PMO through PSA (Principal Scientific Adviser) to the PM/ Government of India. I recently read statistics somewhere that deaths in India due to malaria are more than the deaths due to COVID. Does it not place entomology at a high level of advanced studies in the national context and hence the dire need of at once improving the plight of entomology? I hope one or more of you in the group can take up the matter further and higher up in the hierarchy of Indian science.

Prof Dr RS Sharma (2022): "I agree with you 100% about the plight of Entomologists and entomology as a science in a Public Health Field. Now the regular entomologist cadre is about to die at the National level organisation viz., NVBDCP, NCDC, ICMR. No regular entomologist at NCDC, NVBDCP Delhi and 2 entomologists only at NIMR Delhi. VCRC is also facing the same problem because of common recruitment by ICMR Hq without specialisation and preference for medical doctors. 5 medical doctors are recommended for VCRC and no entomologist is recommended. State entomologists and zonal entomologists in the state's posts are lying vacant. During my tenure at NVBDCP Delhi, we raised and went to Cabinet Secretary, Govt of India for filling these posts and he discussed the issue with all states Chief Secretaries and all agreed at that time, but no posts of Entomologists are filled up. Some of my colleagues have written to the Prime Minister also but no response.

I think the government is not interested in this cadre. Whole life, we entomologists, fought two enemies in the Health Department, one is medical doctors and 2nd IAS officers for senior positions and promotions in the Ministry of Health. Ultimately, the Supreme Court gave the direction for promotions to higher posts for entomologists in Govt. of India. Now the only option is a Public Interest Litigation (PIL) in Supreme Court for filling these entomologists posts."

Prof Dr PKS (2022): "The fact (Destruction of Medical Entomology) cannot be denied as mentioned by Dr Sharma and many times flagged by Dr PKR. The Government realised the necessity of entomologists after the historical resurgence of malaria in 1976 and then created a zonal set-up for entomological monitoring in which one zone was to cover 3-4 districts. NVBDCP has 10 entomologists at the headquarter and 16 entomologists at Regional offices from the central government side now none as regular except some consultants. States had 1-2 at state HQ and one at each zone supported with insect collectors and lab technicians but fully functional are very few. We are targeting elimination of vector-borne diseases without entomologists. This situation is similar in WHO too. Who is the entomologist at SEARO or other regional offices? Endless discussions can go on. Some ad hoc measures are initiated but rightly said that it is only for mosquito collection which is not the entomological study".