REPORT ON RECENT VBC COLLABORATIVE ACTIVITIES IN THAILAND (FILARIASIS) AND INDIA (MICROBIAL CONTROL OF VECTORS)
REPORT ON RECENT VBC COLLABORATIVE ACTIVITIES IN THAILAND (FILARIASIS) AND INDIA (MICROBIAL CONTROL OF VECTORS)

The Role of the Peace Corps in the Filariasis Division in Thailand: Assessment of Potential for Collaboration with VBC

CE-031-3

Attendance of the Informal Consultation on Bacterial Formulations for Cost-effective Vector Control in Endemic Areas (UNDP/World Bank/WHO Special programme for Research and Training in Tropical Diseases)

Pondicherry, India
Vector Control Research Centre
October 19-21, 1988

CE-032-3

Lawrence A. Lacey, Ph.D.
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Author

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The Role of the Peace Corps in the Filariasis Division in Thailand: Assessment of Potential for Collaboration with VBC

Lawrence Lacey, Ph.D.

CE-031-3
Executive Summary

The VBC Project has been a source of technical information for the Peace Corps Volunteers working in Thailand's Division of Filariasis Control. Due to their grass-roots approach, PCVs are in a position to provide assistance in health care and health related issues where it is most needed. They are also able to determine how health delivery systems can be improved. It is my belief that VBC and Peace Corps can synergistically collaborate in health programs.

The objectives of a field visit by VBC Vector Biologist, Lawrence Lacey, to Thailand were to meet with Peace Corps volunteers and discuss their role in the Thai filariasis control program and the constraints to effective control and role VBC can play in addressing unmet needs; and to discuss feasibility of ivermectin trials and the possibility of utilizing technical assistance (TA) for implementation the trials from the National Institutes of Health (NIH). Recommendations resulting from interaction with Peace Corps and Filariasis Control Division staff and tour of two control districts (Pattani and Narathiwat) are:

1) The effectiveness of the Filariasis Control Division could be vastly improved through stratification of resources. Eliminate or reduce frequency of surveys for m.f. in those areas where prevalence of B. malaya and W. bancrofti is negligible.

2) Initial studies on the efficacy of ivermectin have shown that its microfilaricidal activity is longer lasting than that of DEC and has fewer side effects. It may be possible for the Filariasis Control Division and PCVs to conduct field studies of the drug in Thailand with the assistance of NIH researchers. Concomitant with these studies, development and implementation of a drug evaluation protocol will provide filariasis division workers and PCVs with additional technical capability.

3) Encourage effective sterilization of lancets that are used more than once. Currently, lancets may be used several times in the same evening before discarding. If multiple use is dictated by budget, lancets could be re-sterilized (by autoclave or germicidal solution) after each single use.

4) In most cases entomological studies are minimal. In Pattani entomological surveillance is used to determine if blood surveys are warranted (if no biting is observed, no samples are taken). This method could be useful if such surveys
were more regularly carried out. Larval surveys will be useful for possible community-based vector control efforts.

Background

February, 1987, Ms. Rebecca Parks, then Health Program Manager, Peace Corps, Thailand, and Ms. Colleen Conroy, Peace Corps, OTAPS, Washington, D.C. visited VBC and requested information on lymphatic filariasis to assist Peace Corps Volunteers (PCVs) working with the Filariasis Control division in Thailand. Since then literature on filariasis and related topics has been sent to the PCVs on a regular basis. In conjunction with other VBC travel, I had planned to visit the Peace Corps office to assess the technical areas in Filariasis Control in which VBC might be able to assist.

Filariasis and Filariasis Control in Thailand

Both Brugian and Bancroftian filariasis are found in Thailand. Disease caused by *Wuchereria bancrofti* is found predominantly in the north west of Thailand whereas that caused by *Brugia malayi* is found on the Peninsula. Recent surveys North of Tak indicate that Bancroftian filariasis is severe in areas that are not currently part of the control program. The primary vector of *W. bancrofti* is *Aedes nimus*. Four species of *Mansoninae* have been incriminated or suspected as vectors of *B. malayi*, with *M. uniformis* acting as the primary vector. Filariasis control in Thailand is carried out from six district offices (see map) principally through chemotherapy (Diethylcarbamazene, DEC). Surveys for prevalence of microfilaremia and elephantiasis are the basis for drug distribution.

No vector control is conducted by the Filariasis Control Division and entomological studies are minimal in most districts. In terms of potential for supportive entomological studies, the district in Narathiwat at the Phikulthong Center appears to offer the best possibilities. The center is a multidiscipline research facility (includes research on land development, agriculture, forestry, animal husbandry, fisheries, water supply and filariasis control). Although the Narathiwat filariasis district covers less area than the other districts, some of the highest incidence of filariasis occurs there. The laboratory space at the district is ample and includes an insectary (sans *Mansoninae* colony). Limited entomological research has been conducted at the center (flight range and biting studies).

There are some cultural, political and religious problems that are unique to this area. Although the workers speak local dialects and function without impedement in most of the region there are some areas that are not under control due to security problems.
Meetings with Peace Corps Volunteers and the Director and Staff of the Filariasis Control Division

PCVs Shanilka de Soyza, James Meek, Karen Lanham, and James Hubberd met with me to discuss their position and responsibilities in the Filariasis Control Program, the various constraints to effective control and potential for collaboration with VBC. All four volunteers have bachelors degrees in the biological sciences (microbiology, physiology, biology) and have received four to six weeks in public health and filariasis control training in Thailand. Their training in filariasis methodology included blood surveys, slide preparation and reading, mosquito surveys, biting catches and dissections, and health education.

From the PCVs description and from first hand observations, they occupy a position in the filariasis district somewhere between the District Chiefs and the higher level technical staff. They often function as assistants to the chief as well as serve as field workers. They are respected by their Thai counterparts as sources for ideas, resource materials, outside perspectives, and help with some local decisions. They view themselves in a catalytic role for institutionalizing improvements. Rapport between Ms. de Soyza and her fellow workers at the Phikulthong Center was extremely good. The other PCVs were not observed in situ.

The activities of the PCVs that appeared to demand most of their time were surveys for prevalence of microfilaria and distribution of DEC.

Some of the constraints to effective control observed by the PCVs:

1) political factors influencing areas surveyed (or not surveyed)
2) division policy hindering stratification (resources spread over too wide an area)
3) activities carried out solely for the purpose of preventing budget cuts (i.e. use or lose resources)
4) budgetary limitations for projects outside of routine fieldwork
5) lack of technical "know how" to effectively use resources available
6) lack of integrated system to identify, treat and follow up microfilaria positive cases
7) lack of system to store, analyze and utilize data collected in the field.
8) lack of motivation of field staff at some districts (Staff need to know more about the implications of what they do).
Conversations with Dr. Shutidamrong during the courtesy call to the headquarters of the Division of Filariasis Control were cordial and informative. He enthusiastically endorsed the idea of possible TA from VBC including the evaluation of ivermectin. During this visit, he presented me with a copy of their annual report (in Thai).

Because of their education in the biological sciences, PCVs are in a unique position to design, implement and supervise operational research. Possible areas of research include bed net studies, community-based larval control efforts and community-based drug distribution.

Additional Contacts

Informal visits were made with several of the staff members from Mahidol University and AFRIMS that are active in Medical Entomology research. More substantive discussions were held with Dr. Chusak (Malaria Division). He is still very keen on receiving future TA from VBC. Areas that he specifically mentioned are: development of an advanced techniques training course; help with investigation of the rise in dengue and dengue hemorrhagic fever; development of a short-course on non-insecticidal means of vector control; and support for another conference similar to the one held in Pattaya in 1986.
Persons Contacted (in order contacted)

Maj. Ronald Rosenberg, Chief, Medical Entomology, AFRIMS
Mr. James Meek, Peace Corps Volunteer, Filariasis Control
Ms. Karen Lanham, Peace Corps Volunteer, Filariasis Control
Mr. James Hubberd, Peace Corps Volunteer, Filariasis Control
Dr. Chantakorn Shutidamrong,
  Director, Division of Filariasis, Ministry of Public Health
Ms. Puengpit Dulyapach,
  Associate Peace Corps Director, Nutrition, PVO Program
Mr. Oranuch Kunentrasai,
  Library & Documentation Center Tropical Medicine, Mahidol University
Dr. Somsak Patuwantana, Microbiology, Mahidol University
Dr. Chris Green, Microbiology, Mahidol University
Dr. Chusak Prasittisuk,
  Division of Malaria, Ministry of Public Health
Dr. Kazuo Tanaka, Medical Entomology Consultant, JICA
Dr. Motoyoshi Mogi, Medical Entomology Consultant, JICA
Ms. Shanilka de Soyza, Peace Corps Volunteer, Filariasis Control
Mr. Jirapat Ketkaew,
  Chief, Filariasis Control, Phikulthong Center, Narathiwat
Mr. Jibra Boonyang,
  Acting Assistant Director, Regional Malaria Office, Songkla
Mr. Sarote Wechgoon,
  Assistant Chief, Regional Filariasis Control Center, Pattani
Attendance of the Informal Consultation on Bacterial Formulations for Cost-effective Vector Control in Endemic Areas (UNDP/World Bank/WHO Special programme for Research and Training in Tropical Diseases)

Pondicherry, India
Vector Control Research Centre
October 19-21, 1988

Lawrence Lacey, Ph.D.

CE-032-3
EXECUTIVE SUMMARY

The World Health Organization sponsored an informal consultation on formulation of microbial agents for vector control at the Vector Control Research Centre in Pondicherry, India, October 19 - 21. VBC Vector Biologist, Lawrence Lacey, attended the meeting, served as rapporteur, and presented a paper on controlled-release formulations of microbial control agents of mosquitoes.

The meeting covered six subject areas including: factors influencing suitability and efficacy of insecticide formulations; current status of formulation of microbial control agents; controlled-release formulation of microbial agents; ecology and feeding behavior of target vector larvae in relation to the need for tailor-made formulations of microbial control agents; techniques and equipment for application of microbial formulations; and risk-benefit analysis and ecological considerations governing delivery of genetically-engineered microbial agents to target vector larvae.

The exchange of information among the various participants (temporary advisors, WHO Steering Committee on Biological Control, observers and WHO Secretariat) resulted in the drafting of recommendations that help direct research efforts in the WHO/TDR program as well as to directly stimulate the research efforts of the meeting attendees.
BACKGROUND

Due to the development of resistance in vector insects to several conventional chemical insecticides and to concern over the untoward effects of such insecticides, WHO and other organizations have promoted the development and use of biological control agents. Some of the most efficacious of these agents are bacteria and fungi.

In order to control mosquito larvae in the wide variety of habitats they occupy, formulated materials that enable delivery to the habitats and permit sustained contact with vector larvae will be required. Industry and research institutions have responded to these needs by producing several formulations. Because of the enormous diversity of disease vectors and the habitats they occupy, standard formulations of microbial control agents will not provide satisfactory and cost-effective control in all situations. For some vectors and in certain situations, tailor-made formulations have to be employed in conjunction with other control strategies. These formulations are primarily designed to reach the target species in its specific habitat and to provide long-lasting control of asynchronous and multivoltine species.

At the present time, there is a great need for the development and use of controlled release formulations for residual control of multivoltine vector species. Since the toxins of currently used bacterial agents are insoluble in water, the toxin molecules do not leach out of conventional matrices and diffuse through the water medium. The requisite for controlled-release microbial formulations is disintegration of the formulation constituents thereby freeing the toxin particles from the inert base of matrix and making them available to target larvae. Such formulations are ideal for the control of several vectors of malaria, filariasis and arboviruses (Anopheles, Aedes, and Culex mosquitoes).

Microbial control agents are considerably more difficult to formulate than are their chemical counterparts. As living entities or biologically produced by-products (toxins) of living organisms they are subject to being killed or denatured under a variety of conditions that may not affect conventional insecticides. For example, the fungus Lagenidium giganteum is killed or becomes non-infective under conditions of high pH or in the presence of certain ions (chloride). Likewise toxins of Bacillus thuringiensis H-14 and B. sphaericus are denatured under conditions of high pH. In addition to the actual effects of formulation processes and constituents on the microbial agent, the target species and habitat to be treated must also be considered when developing and using a formulation. To address these and other areas of formulation research an Informal Consultation on Bacterial Formulations for Cost-effective Vector
Control in Endemic Areas was held in Pondicherry, India at the Vector Control Research Centre from 19-21 October 1988 under the sponsorship of the UNDP/World Bank/WHO Special Programme for Training and Research in Tropical Diseases. The consultation was attended by 24 participants (temporary advisors, members of the WHO Steering Committee on biological control of vectors, observers from the WHO Secretariat) and several students and staff from the VCRC (see Annex I). Six subject areas were covered in working papers and discussions. These included:

- factors influencing suitability and efficacy of insecticide formulations;
- current status of formulations of microbial control agents;
- controlled-release formulations of microbial agents;
- ecology and feeding behavior of target vector larvae in relation to need for tailor-made formulations of microbial control agents;
- techniques and equipment for application of microbial formulations; and
- risk-analysis and ecological considerations governing delivery of genetically-engineered microbial agents to target vector larvae.

The schedule for the meeting is given below.

WEDNESDAY, OCTOBER 19

9:00 Opening of Meeting

Factors influencing suitability and efficacy of insecticide formulations

9:30 Working paper TDR/BCV(ICBF.88/6.1: Physiochemical factors influencing suitability and efficacy of pesticide formulations. Speaker: Mr. Speight

9:50 Working paper TDR/BCV(ICBF.88/6.2: Insecticide formulation technology. Speaker: Dr. Khetan

10:10 Discussion

10:30 Coffee break

Current status of formulations of microbial control agents

10:50 Working paper TDR/BCV(ICBF.88/6.3: Review of microbial
formulations for vector control.
Speaker: Dr. Balaraman

11:10 Working paper TDR/BCV/ICBF.88/6.4: Formulation requirements of other biological control agents such as fungi, microsporidia, nematodes, etc. Speaker: Dr. Vavra

11:30 Working paper TDR/BCV/ICBF.88/6.5: Novel formulation techniques for entomopathogenic fungi (e.g. Lagenidium giganteum). Speaker: Dr. Lacey (for Dr. Axtell)

11:50 Working paper TDR/BCV/ICBF.88/6.6: Influence of starting materials on microbial formulation efficacy. Speaker: Dr. Luthy (for Dr. Dulmage)

12:10 Discussion

12:30 Lunch

2:00 Working paper TDR/BCV/ICBF.88/6.7: Safety testing requirements. Speaker: Dr. Chapman (for Dr. Shadduck)

2:20 Working paper TDR/BCV/ICBF.88/6.8: Laboratory and field testing of microbial formulations against mosquitoes. Speaker: Dr. Napompeth

2:40 Working paper TDR/BCV/ICBF.88/6.9: Laboratory and field testing of bacterial larvicide formulations against black flies. Speaker: Dr. Guillet

3:00 Discussion

3:30 Coffee

3:50 - 5:30 Formation of writing groups and drafting of Report

Thursday, October 20

Controlled-release formulation of microbial agents

9:00 Working paper TDR/BCV/ICBF.88/6.10: Controlled-release formulation of microbial agents of mosquitoes. Speaker: Dr. Lacey

9:20 Discussion

Ecology and feeding behavior of target vector larvae in relation
to need of tailor-made formulations of microbial control agents.


10:00 Working paper TDR/BCV/ICBF.88/12: Ecology and feeding behavior of target larvae in relation to impact of microbial formulations - factors influencing ingestion rates of particulate materials. Speaker: Dr. Aly

10:20 Discussion

10:30 Coffee


11:05 Working paper TDR/BCV/ICBF.88/14: Formulation requirements against Culex and Aedes. Speaker: Dr. Bhumiratana

11:20 Working paper TDR/BCV/ICBF.88/15: Formulation requirements against Mansonia. Speaker: Dr. Yap Han Heng

11:35 Working paper TDR/BCV/ICBF.88/16: Formulation requirement against floodwater mosquito species. Speaker: Dr. Chapman

11:50 Working paper TDR/BCV/ICBF.88/17: Requirements for black fly larvicide formulations. Speaker: Dr. Guillet.

12:05 Working paper TDR/BCV/ICBF.88/18: Formulation requirements against snails. Speaker: Dr. Odei.

12:20 Discussion

12:30 Lunch

2:00 Working paper TDR/BCV/ICBF.88/19: Host-specificity of tailor-made formulations vs. broad-spectrum materials in cost effective vector control programs. Speaker: Dr. Mulla

2:20 Discussion

Techniques and equipment for application of microbial control agents.
formulations

2:40 Working paper TDR/BCV/ICBF.88/20: Application of Bacillus thuringiensis serotype H-14. Speaker: Mr. Speight (for Dr. Matthews)

3:00 Working paper TDR/BCV/ICBF.88/21: Innovative approaches to application of microbial formulations in specific situations in developing countries. Speaker: Dr. Rajagopalan

3:15 Discussion

3:30 Coffee

3:50-5:30 Drafting of report

Friday October 21

Risk-benefit analysis and ecological considerations governing delivery of genetically-engineered microbial agents to target vectors.

9:00 Working paper TDR/BCV/ICBF.88/22: Delivery of genetically-engineered organisms. Speaker: Dr. Klier


9:40 Discussion

10:00 Writing reports for the day's presentations

10:30 Coffee

10:50 Finalization of report

12:30 Lunch

2:00 Drafting of recommendations

3:00 Approval of recommendations

4:00 Approval of report
Closure of meeting

At the conclusion of discussion following the presentations on October 19th and 20th, three to four writing and discussion groups were formed to summarize the papers that were presented, the discussion that followed and to draft preliminary recommendations. On the final afternoon of the meeting, the entire group of participants presented and discussed the various recommendations. The key issue that was discussed was the need for those involved in research on the formulation and use of microbial control agents of vectors to develop collaborative links with formulation chemists. Proper understanding of the microbes utilized, including their efficacy and limitations, the formulation modifications that can enable their improved use in various habitats against a spectrum of vector species and the most appropriate selection of adjuvants and diluents for formulations will be an integrated process involving several unrelated skills (invertebrate pathology, microbiology, vector ecology and control and formulation chemistry). An edited version of the consultation proceedings and recommendations will be available in the near future from WHO, Geneva.

ADDITIONAL CONTACTS

In addition to subject matter covered in the meetings, I spoke with the following individuals on other topics:

- Dr. V. P. Sharma, Director of the Malaria Research Centre (New Delhi) regarding training and other activities of the VBC Project. Several reports were subsequently sent to him via Dr. Jim Sherry, Director, Office of Biomedical Research and Development, USAID/New Delhi.

- Dr. P. K. Das, Deputy Director, VCRC regarding information management software and help VBC (VCIC) might be able to provide in development of VCRC's system.

- Drs. J. Akiyama (SEARO, New Delhi) and N. Rishikesh (WHO/VBC/Geneva) regarding operational research on bed nets in West Timor.

- Dr. H. C. Chapman, Executive Director, American Mosquito Control Association, regarding current trends and needs in operational research for vector control.
ANNEX I
Informal Consultation on Bacterial Formulations
for Cost-effective Vector Control in Endemic Areas
Pondicherry, India, 19-21 October 1988

List of Participants

Temporary Advisors

Dr. Christopher Aly, Hohenhardter Str. 4, 6908 Wiesloch-Schatthausen, Federal Republic of Germany

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Dr. C.I. Dahl, Professor of Entomology, Department of Zoology, Section of Entomology, Uppsala University, Box 561, S-751 22 Uppsala, Sweden

Dr. S. Khetan, Pesticide Development Programme of India, Research & Development Center, Hindustan Insecticides Ltd., Gurgaon, Haryana, India

Dr. L. A. Lacey, Vector Biology & Control Project, 1611 North Kent Street, Suite 503, Arlington, VA 22209, USA

Dr. P. K. Rajagoplan, Director, Vector Biology Research Centre, Medical Complex, Indira Nagar, Pondicherry 605006, India

Dr. Xu Bozhao, Institute of Parasitic Disease Control and Research, Wuchang, Wuhan, Hubei, People's Republic of China

Members of Steering Committee on Biological Control of Vectors

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Dr. A. Klier, Laboratoire de Biochimie Microbienne, Institut Pasteur, 28 rue du Dr Roux, 75724 Paris Cedex 15, France

Dr. P. Luthy, Mikrobiologisches Institut, Eidgenossische Technische Hochschule, Universitatstrasse 2, CH-8092 Zurich, Switzerland

Dr. M. S. Mulla, Professor of Entomology, Department of Entomology, College of Natural and Agricultural Sciences, University of California, Riverside, CA 92521, USA

Dr. B. Napompeth, Executive-General, National Biological Control
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Dr. J. Vavra, Vice-Dean, Faculty of Sciences, Head, Department of Parasitology, Charles University, 128 44 Prague 2, Vinicna, Czechoslovakia

Dr. Yap Han Heng, Associate Professor, Coordinator of Vector Control Project, Program Chairman for Entomology/Parasitology, School of Biological Sciences, Universiti Sains Malaysia, Minden Campus, Pulau Pinang, Malaysia

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Dr. V. P. Sharma, Director, Malaria Research Centre (IMCR), 22 Sham Nath Marg, Delhi-110054, India

Mr. B. Speight, Shell Research Ltd., Sittingbourne, Kent ME9 8AG, United Kingdom

Secretariat

Dr. J. Akiyama, Regional Entomologist, World Health Organization, Regional Office for Southeast Asia, World Health House, New Delhi 110002, India

Dr. B. Dobrokhotov, Secretary, Steering Committee of the Scientific Working Group on Biological Control for Vectors, UNDP/World Bank/WHO Special Programme for Research and Training in Tropical Diseases, World Health Organization, Geneva, Switzerland

Dr. P. Guillet, World Health Organization, Onchocerciasis Control Programme, B. P. 2279, Bamako, Mali

Dr. N. Rishikesh, Secretary, Steering Committee of the Scientific Working Group on Biological Control for Vectors, UNDP/World Bank/WHO Special Programme for Research and Training in Tropical
Diseases, Chief, Unit of Development of Vector Control Technology, Decision of Vector Biology and Control World Health Organization, Geneva, Switzerland
ANNEX II

Itinerary

Oct 11
Arrived in Bangkok
Visit to AFRIMS
Briefing for Dr. Rosenberg regarding VBC activity in W. Timor

October 12
Meeting with Peace Corps Volunteers
Meeting with Chief, Filariasis Control
Visit to Peace Corps Office
Tour of Library and Document Center, and Museum of Tropical Medicine, Mahidol University
Informal meeting with Drs. Chusak (Malaria Control), Somsak and Green (Mahidol), and Tanaka and Mogi (JICA)

October 13
Departure from Bangkok
Arrival in Hat Yai, Thailand
Travel by car to Filariasis Control District Offices in Pattani and Narathiwat

October 13 - 16
Tour of P.C. research facility at Narathiwat
Discussion of research capability of Filariasis District, constraints to effective control of filariasis and role of Peace Corps in the effort. Visit to village where blood survey and community health education were being conducted. Participation in drug distribution rounds and blood survey.

October 16
Depart Narathiwat en route to Madras via Hat Yai and Singapore

October 18
Arrival in Madras, India
Travel by car to Pondicherry

October 19-21
Informal consultation on formulation of microbial control agents of vectors held at Vector Control Research Center, Pondicherry

October 22
Depart Pondicherry en route to Washington, via Madras, Bombay and Frankfurt

October 23
Arrive in Washington, DC