1ST INTERNATIONAL MALARIA VECTOR SURVEILLANCE FOR ELIMINATION COURSE
18-28 November 2018, MALAYSIA

Jointly organized by:

ACTMalaria

APMEN

and the Ministry of Health Malaysia

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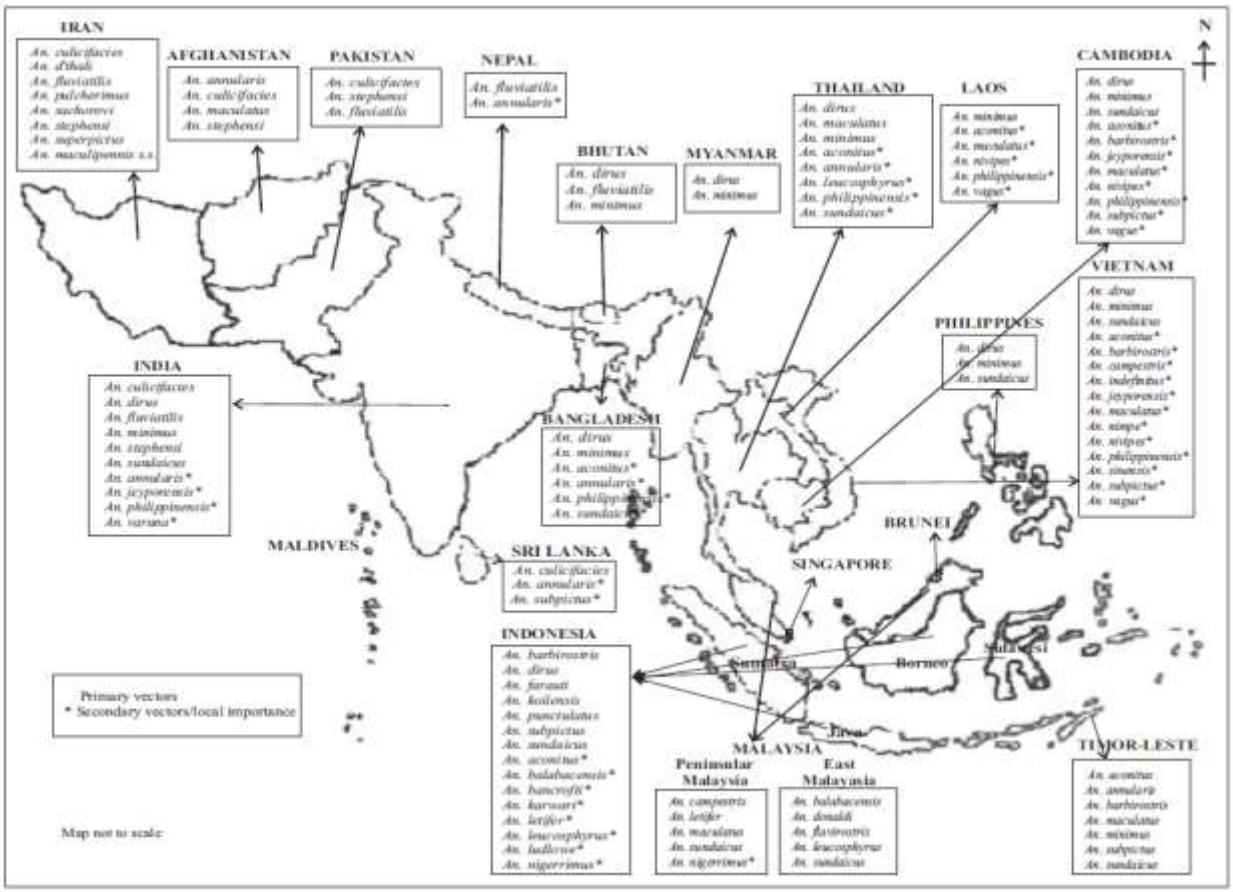
1. Background and Rationale

The Asia Pacific region (including the Greater Mekong Subregion) is home to a great diversity of anopheline mosquitoes, many of whom are considered malaria vectors at some points throughout their range (Sinka et al. 2011; Hii and Rueda 2013; St Laurent et al 2016; Oo et al. 2004). Two illustrations from a 2007 WHO publication (Fig. 1) and from Sinka et al (2011) show the diversity of Anopheline fauna that exists within Southeast Asia is richer than in any other region of the world; at least 19 species, some of which comprise cryptic species complexes, are known to play some role in malaria transmission. Exactly 50% of the 24 currently recognized Anopheles species complexes are found within Asia, which when compared with the 21%, 13%, 13% and 4% found in the Americas, Africa, Australia-Pacific and Europe, respectively, emphasizes the complexity of diversity found within the Asian continent.

Figure 1: Malaria vectors prevalent in South Asia, South-East Asia and neighbouring countries



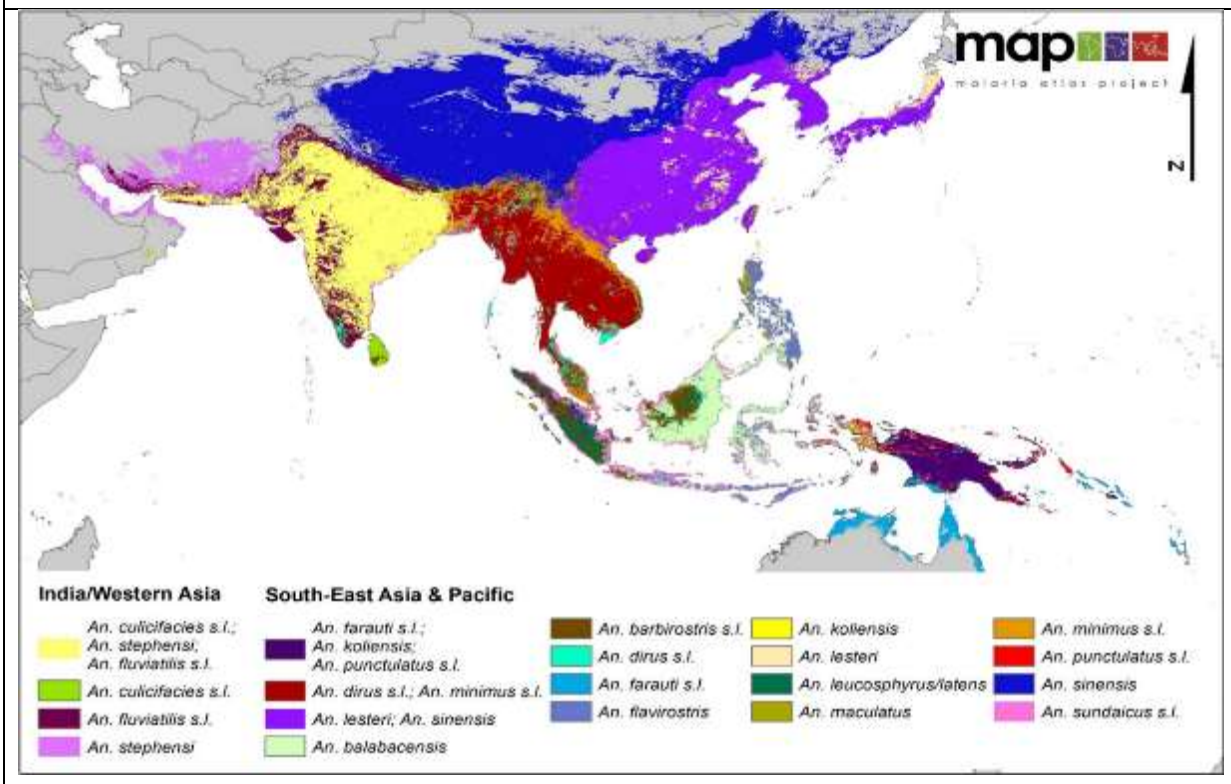


Fig. 2. A regional map showing the distribution of 16 dominant malaria vectors in the Asian-Pacific region (Sinka et al 2012).

In previous decades, when there was much more forest cover and very high levels of malaria transmission throughout the GMS, most programs could concentrate simply on *An. balabacensis*/*dirus* s.l. and *An. minimus* s.l. and achieve significant control. With the rapidly changing ecologies, deforestation on one side and development of orchards and plantations on the other, the mosquito fauna and relative abundance of potential malaria vectors has changed tremendously. "Secondary Vectors" including species in the Hyrcanus Group, the Maculatus Group and the Barbirostris Group may be gaining in importance, just as the *An. dirus* s.l. populations decline.

Expansion of entomological monitoring, beginning with accurate morphological identification is especially important now with a great variety of these "secondary vectors" suspected to be involved in focal malaria transmission GMS National Programmes and partners currently use a variety of keys developed in the region over the past three or four decades. One commonly in use now is the Rattanarthikul et al (2006) illustrated key for the Anopheles of Thailand. Vietnam has another key by Nguyen et al 2008 and Myanmar often uses a pictorial key developed by JICA 2009. Malaysia use the old 1968 pictorial keys for the Anopheles of Malaysia and Borneo (Reid JA 1968).

The Malaria control and elimination in the Asia Pacific region is at a critical juncture. While national strategies are shifting from long-term, traditional control or containment to Malaria Elimination, the entomology and vector control services are needed to shift their strategies and build capacities in order to

achieve this. This requires NMCPs to manage adequate trained personnel and resources including entomologists for elimination and the prevention of re-introduction phases.

The aim of this course is to ensure national program entomologists in the countries are trained in entomological surveillance and best practice field and laboratory techniques relevant to control and elimination settings; this capacity building exercise hopes to also contribute to achievement of the regional targets set for malaria elimination, by making vector control more efficient, cost effective, ecologically sound and sustainable.

2. Objectives

2.1. General

The course aims to equip and support entomologists involved in malaria control and elimination programmes with necessary knowledge and skills to support capacity building and application of entomological and vector control strategies.

2.2 Specific objectives

By the end of the course, the participants should be able to:

- Use *Anopheles* species identification key and describe the main biochemical and molecular methods used in the identification of mosquito vectors
- Rear and maintain *Anopheles* mosquitoes under insectary conditions and understand the specific requirements and methods for mosquito rearing.
- Determine resistance to insecticides using the WHO susceptibility test kit (adults) and CDC bottle bioassay including intensity of resistance, synergist-insecticide bioassays and biochemical tests to determine mode of resistance
- Assess durability of Long-Lasting Insecticidal Nets (LLINs) and determine the residual efficacy of an insecticide-treated net at any particular time after distribution
- Apply adult and larval mosquito collection methods for focal investigations in areas of new or persistent malaria transmission to determine why there is transmission or why the disease is not responding to the measures being applied, and to identify the best approaches to control.

3. Arrangements and preparation

During the APMEN Vector Control Working Group (VCWG) meeting held on 12-14 July 2017 in Bangkok, Thailand (http://apmen.org/events/working-group-meetings/61/vector-control-working-group.html), NMCP and stakeholders identified priority topics where vector surveillance should be strengthened such as: vector identification and taxonomy, mosquito rearing, entomological surveillance for elimination and prevention of reintroduction, multiple vectors, collection methods, sampling strategy, bionomics study, entomological indicators, data interpretation and evaluation of results and impact, larval breeding site surveillance. Insecticide resistance monitoring, GIS mapping, monitoring and evaluation and management of foci.

Stakeholders concurred that priority be given to improve skills and competencies in identification of malaria vectors and *Anopheles* mosquitoes as this is critical to the successful implementation of any vector control strategy.

To facilitate progress toward strengthening regional entomological and vector control capacity, ACTMalaria, APMEN and the Ministry of Health Malaysia (MoH) jointly convened this first international training course in Malaria Vector Surveillance for Elimination. A series of meetings, teleconference and exchanges were conducted in preparation for this course since August 2018 until the week before the course was conducted in November.

External resource speakers were invited from the WHO Western Pacific Regional Office, Centers for Disease Control, Atlanta, USA and Walter Reed Biosystematics The course was co-funded by Bill and Melinda Gates Foundation (BMGF) through APMEN, the President's Malaria Initiative (PMI) / USAID through ACTMalaria / WPRO / WHO and by the Ministry of Health Malaysia.

4. Participants

The following criteria were provided to program coordinators for selection of participants:

a) practicing field entomologists or vector control technicians with responsibilities in malaria control and elimination programmes, training, implementation, monitoring and evaluation at either national/provincial or municipal/district level;
b) undergraduate or postgraduate qualifications in medical entomology and/or parasitology;
c) communicate effectively in English with good reading, writing and spoken skills; and
d) interact constructively with colleagues from different social, political, and cultural backgrounds.

In reality, participants comprised a mix of program (n=20) and research/academic (n=3 entomologists, environmental health and microbiologist from 10 countries representing the Asia-Pacific, see Table 1 below for background information of participants.

Table 1
List of participants
1st MVSE, 2018

Country	Designation (Sex)	Education	Work experience
Philippines (1)	Entomologist III (male)	Master Public Health	Medical Lab technician: 1992-2003; Entomologist: 2003- present
Vanuatu (1)	Senior Vector Control Officer (male)	Secondary level	2018- Present: Vector Control Officer 2010-2014: Supply Officer 2005-2014: Stock Control Officer
Republic of Korea (2)	Deputy Director CDC (male)	Master in Biology, PhD Microbiology	2017-Present: Deputy Director CDC 2002-2017, Researcher and Staff Scientist
Bangladesh (2)	Entomologist (male)	Diploma in Applied Parasitology & Entomology (DAPE); Master in Zoology	2015-Present, Entomologist 2009-2015, National Consultant (Entomology) 2004-2009, Entomologist 2001-2004, Divisional Entomologist

	Senior Research officer (male)	Bachelor in Zoology, Master in Zoology (Entomology),	2018-present, Senior Research Officer 2016-2017, Research Officer; 2012-2016 Senior Research Assistant
Bhutan (1)	Medical Technician (male)	Certificate in Medical Laboratory Technician	2015-Present, Assistant Medical Laboratory Technician
Solomon Islands (1)	Program manager Vector control (male)	Bachelor of Applied Science; Master in Public Health and Tropical Medicine; doctoral student	2001-Present, Program Manager
China (1)	Entomologist Jiangsu Institute of Parasitic Diseases (male)	Bachelor of Preventive Medicine; Master, Vector Control	2017-Present, Entomologist
Thailand (2)	Lecturer & researcher (female)	B.S./MSc Agriculture (Entomology), PhD	2017-Present, Lecturer (Kasetsart University)
	Public Health Technical Officer, Ministry of Public Health (female)	Bachelor in Pest Management (Agricultural); MSc in Entomology	2014-Present, Public Health Technical Officer (Professional Level) 2009-2014, Public Health Technical Officer (Practitioner Level)
Vietnam (2)	Deputy Chief (male)	Bachelor in Biology; MSc in Zoology; PhD (Entomology)	2012-Present, Deputy Chief Department of Entomology (NIMPE)
	Deputy Chief (female)	Bachelor in Biology; MSc in Biochemistry; PhD (Entomology)	2006-2012 Researcher, NIMPE 2012- present, Main Researcher, Deputy Chief Department of Entomology"
Pakistan (1)	Research Specialist, Agha Khan Uni Hospital (female)	Bachelor/Master in Clinical Microbiology	2018-Present, Research Specialist 2013-2018, Research Coordinator 2009-2013, Research Officer
Cambodia (2)	Provincial Malaria Supervisor assistant (male)	Bachelor in General Management; Associate Degree in Nursing	2007-2017, Malaria Program Officer; 2017-Present, Provincial Malaria Supervisor Assistant
	Head of Entomology unit, (female)	Bachelor in Pharmacy; Master degree in Public health	2012 - present: Head of Entomology unit, National Center for Parasitology Entomology and Malaria Control (CNM)
Malaysia (7)	Entomologist (female)	BSc Hon (Animal Biology)	2006-Present, Entomologist (Johor state)
	Entomologist (female)	DAPE; BSc (Hons Zoology), MSc (Entomology)	2005-Present, Entomologist (Perak state)
	Entomologist (female)	MSc (Entomology)	2004-Present, Entomologist (Sabah state)
	Entomologist (female)	BSc Hons (Zoology)	2006-Present, Entomologist (Trengganu)
	Entomologist (female)	BSc Hons (Animal Biology) B Appl Sc (Vector and Parasite Management)	2014-Present, Entomologist (Pahang state)
	Entomologist (male)	BSc. Hons (Zoology)	2006-Present, Entomologist (Sarawak state)
	Entomologist (male)	BSc. Hons (Environmental Biology)	2006-Present, Entomologist (Pahang state)

5. Resource Speakers and Facilitators

Topic/session allocation to resource speakers are as shown in table 2 and indicated in the course agenda/timetable (Annex 1).

Table 2
List of External/International Resource Speakers
1st MVSE, 2018

No.	Name of Speakers	Position/Designation Organization	Topic(s) PPT presentations
1	Rogelio Mendoza, Jr.	Information technology Officer/Admin support ACTMalaria, Philippines	1.1 Introduction to WHO Training Module on Malaria Entomology and Vector Control (E-module)
2	Matthew Shortus	Techncial Officer Malaria & other Vector Borne & Parasitic Disease World Health Organization Representative Office Lao PDR	1.2 Role of Entomological Surveillance in Elimination Program 1.3 Vector Control Response in Elimination: Management of Insecticide Resistance (WHO) 3.5 IR WMR form for IR reporting to WHO
4	Jeffrey Hii, PhD	Chief of Party PMI Vectorlink Project Cambodia Entomology Training Consultant ACTMalaria	1.5. Bionomics of Dominant Malaria Vectors in Asia-Pacific 3.1 Monitoring and evaluation of vector control, including indicators 3.2.1 Cone bioassays on walls of sprayed houses 3.2.2 Cone bioassays on bednets 3.3 LLIN Durability monitoring 3.4 Results interpretation
5	Leopoldo M. Rueda, PhD	Adjunct Scientist Smithsonian Institution, Museum Support Center (MRC 534), Suitland, Maryland 20746 USA Entomology Training Consultant- ACTMalaria	2.1 Sampling techniques 2.2 Briefing/ prepration for the adult mosquito collection - recording, reporting &use of GPS/smartphone with GPS] 2.3.1 Night Adult Collection with few methods (HLC, HBT, ABT, Light trap, Resting catch) 2.3.2. Adult sample processing 2.4.1 Larval Sampling 2.4.3 Larval sample processing 2.5 Identification of Adult 2.6 Identification of Larva 2.7 Preparation of specimens for transport

6	Adeline Chan, MPH, PhD	Research Entomologist Centers for Disease Control and Prevention Entomology Branch Atlanta, GA, USA	4.1.1 WHO test procedures for IRM in malaria vector mosquitoes 4.1.2 Insecticide Resistance Monitoring [Preparation of WHO Test tube] 4.2.1 CDC Bottle assay (Theory) 4.3.1 Susceptibility tests with discriminating concentrations
9	Ms. Cecilia Hugo	Executive Coordinator ACTMalaria, Philippines	Panel Discussion; Post Course Evaluation

Table 3
Roles/input of local resource speakers and facilitators
1st MVSE, 2018

No	Name	Designation/Organization	Topics
1	Dr Rose Nani Mudin	Epidemiologist Vector Borne Disease Control Sector, Putrajaya	1. Malaria Elimination Programme – Malaysia Experience 2. Field Visit to Bentong District Health Office
2	Mdm Sharifah Milkah Syed Abdul Rahman	Entomologist National Public Health Laboratory	Module 4: Insecticide Resistance Monitoring
3	Ms Perada Wilson	Entomologist Vector Borne Disease Control Sector, Putrajaya	Module 2: Sampling of malaria vectors Module 3:Surveillance, monitoring and Evaluation of vector control Module 4: Insecticide Resistance Monitoring
4	Mdm Rosilawati Rasli	Entomologist Institute for Medical Research	Module 4: Insecticide Resistance Monitoring
5	Mr Topek Omar	Entomologist Vector Borne Disease Control Sector, Putrajaya	Module 2: Sampling of malaria vectors Module 3:Surveillance, monitoring and Evaluation of vector control Module 4: Insecticide Resistance Monitoring
6	Mr Kamilan Demin	Entomologist Selangor State Health Department	Module 2: Sampling of malaria vectors Module 3:Surveillance, monitoring and Evaluation of vector control
7	Mdm Nor Jaiza Muhammad Jaafar	Entomologist Pahang State Health Department	Module 2: Sampling of malaria vectors Module 3:Surveillance, monitoring and Evaluation of vector control
8	Mdm Fadzillah Mohd Jaafar	Entomologist Melaka State Health Department	Module 4: Insecticide Resistance Monitoring
9	Mr Mazlan Mohd Isa	Entomologist Pahang State Health Department	Module 2: Sampling of malaria vectors Module 3: Surveillance, monitoring and Evaluation of vector control
10	Mr Hisyamudin Hapis	Entomologist Negeri Sembilan State Health Department	Module 2: Sampling of malaria vectors Module 3:Surveillance, monitoring and Evaluation of vector control

11	Mr Azahari Abdul Hadi	Scientific Research Officer Institute for Medical Research	Module 2: Sampling of malaria vectors Module 3:Surveillance, monitoring and Evaluation of vector control
12	Mr Mohamad Shakirudin Ngah	Medial Laboratory Technologist Institute for Medical Research	Module 2: Sampling of malaria vectors Module 3:Surveillance, monitoring and Evaluation of vector control
13	Mdm Safnatul Salisa Ismail	Entomologist Vector Borne Disease Control Sector, Putrajaya	Module 2: Sampling of malaria vectors Module 3:Surveillance, monitoring and Evaluation of vector control Module 4: Insecticide Resistance Monitoring
14	Mdm Nor Aszlina Ismail	Entomologist Selangor State Health Department	Module 4: Insecticide Resistance Monitoring
15	Mr Mohd Maher bin Ibrahim	Entomologist Pahang State Health Department	Module 2: Sampling of malaria vectors Module 3:Surveillance, monitoring and Evaluation of vector control
16	Mdm Nurhanani Ibrahim	Entomologist Pahang State Health Department	Module 2: Sampling of malaria vectors Module 3:Surveillance, monitoring and Evaluation of vector control
17	Mdm Nurul Huda Noordin	Entomologist National Public Health Laboratory	Module 4: Insecticide Resistance Monitoring
18	Mdm Nor Atika Abd Manap	Entomologist Vector Borne Disease Control Sector, Putrajaya	Module 2: Sampling of malaria vectors Module 3:Surveillance, monitoring and Evaluation of vector control Module 4: Insecticide Resistance Monitoring
19	Mdm Rafidah Ali	Entomologist Institute for Medical Research	Module 4: Insecticide Resistance Monitoring
20	Dr Nazni Wasi Ahmad	Entomologist Institute for Medical Research	Module 5: Colonization of Anopheles Mosquito
21	Dr Rohani Ahmad	Head, Department of Medical Entomogy Institute for Medical Research	Module 5: Colonization of Anopheles Mosquito
22	Mdm Wan Najdah Wan Mohd Ali	Entomologist Institute for Medical Research	Module 5: Colonization of Anopheles Mosquito
23	Mr. Ahmad Fakhriy Hassan	Entomologist Institute for Medical Research	Module 5: Colonization of Anopheles Mosquito

6. Course Materials

The training programme was based on five learning modules, each consisting of learning objectives, outputs, theory, guidelines, examples, problem solving and data interpretation. The WHO Module on Malaria Entomology and Vector Control Learner's and Tutor's guide were made available to participants and tutors/facilitators. They were taught in a sequence starting with Introduction to the WHO e-learning module on Malaria Entomology and Vector Control; Role of Entomological Surveillance in Elimination Programmes; Malaria Elimination Programme - Malaysia; Bionomics of Dominant Vectors in Asia Pacific

(Module 1) followed by Module 2: Sampling of malaria vectors, Module 3: Surveillance, monitoring and Evaluation of vector control; Module 4: Insecticide Resistance Monitoring; and Module 5: Colonization of Anopheles Mosquito. WHO reference materials used in the course are as follows:

- Global vector control response 2017-2030, Geneva, World Health Organization; 2017.
- Guidelines for monitoring the durability of long-lasting insecticidal mosquito nets under operational conditions. World Health Organization 2011. WHO/HTM/NTD/WHOPES/2011.5
- Guidelines for testing mosquito adulticides for indoor residual spraying and treatment of mosquito nets. World Health Organization 2006. WHO/CDS/NTD/WHOPES/GCDPP/2006.3.
- Indoor residual spraying: an operational manual for indoor residual spraying (IRS) for malaria transmission control and elimination – 2nd edition. World Health Organization 2015.
- Malaria entomology and vector control: Guide for participants. Training module on malaria control; 2013. WHO (e-module and hard copy)
- Malaria surveillance, monitoring & evaluation: a reference manual. Geneva: World Health Organization; 2018.
- Monitoring and evaluation indicators for integrated vector management. World Health Organization 2012. WHO/HTM/NTD/VEM/2012.4.
- Test procedures for insecticide resistance monitoring in malaria vector mosquitoes – 2nd ed, Geneva, World Health Organization; 2016 (with updates in June 2018)

Other teaching materials used during the training by the resource speakers are listed in section 11.

7. Conduct

The course which was conducted in 10 days was designed to be practice-oriented with individual and group exercises in the laboratory and field, where possible, were given in all the modules The teaching methodology was participative; each session started with a presentation, where the facilitator engaged the participants in question and answer and discussion; after completing all the lecture/presentations, hands-on practice were worked out by the five groups assisted by the assigned facilitators.

Other learning techniques used included a quality control quiz, case studies, problem-solving exercise, laboratory and field demonstrations and field visits and a questionnaire survey of country's entomological surveillance.

The course was held in 2 sites, i.e., Bentong Pahang state for the field sampling and monitoring and in Lab Botanik in Selangor for the susceptibility and bioassay testings.

All the training materials were uploaded daily in the MVSE website and compiled in flash drive that was given on the closing ceremony including some of the photos taken during the training.

Participants submitted the results of a simplified survey of entomological surveillance (Fig 3 and 4) which highlighted some of the critical areas that are consistently low scoring (i.e. using ento data for decision making, capacity and collecting annual density data).

Fig 3
Frequency of responses (y-axis) to 28 questions on entomological surveillance of nine countries represented in the course
1st MVSE-2018

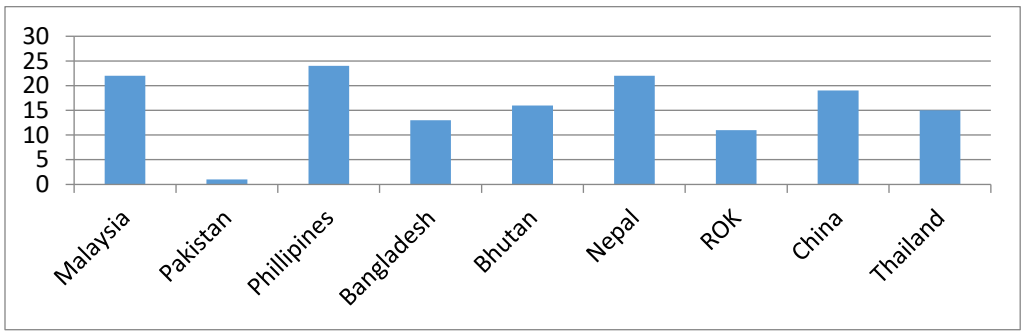
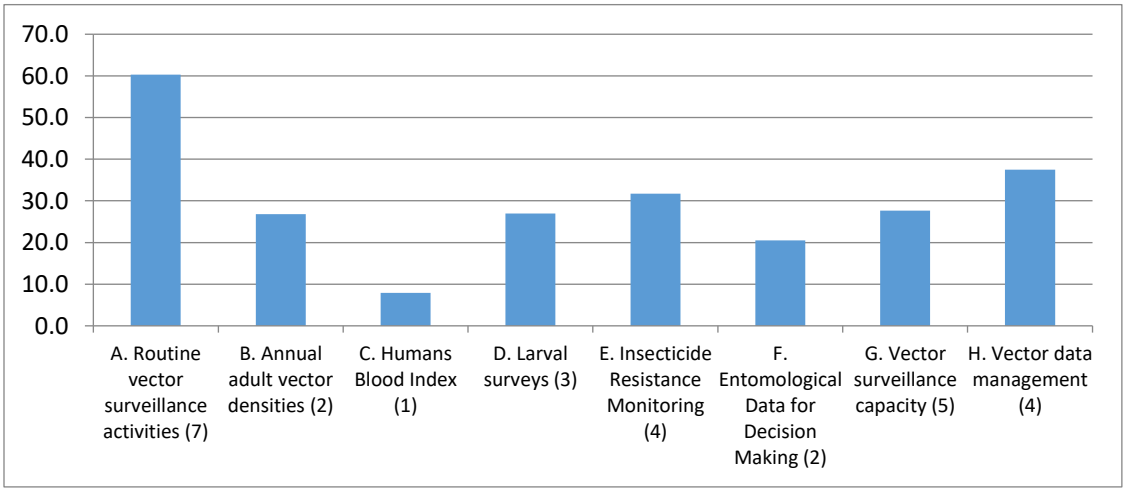


Fig 4
Frequency of responses to each of the 8 subject areas of entomological surveillance
Parentheses show the number of questions for each subject area
1st MVSE, 2018



8. Evaluation

8.1 Participants' Evaluation

Theoretical test: The evaluation instruments used were pre-tests in all five modules given on the first day upon entry into the course before any training materials were distributed. Post-tests were given in the same subjects soon after completing those related to the subject areas. Secretariat used Google form format to get the result from the participants. The test form is attached (Annex 2). All pre and post tests theoretical consisted of multiple-choice type questions and all had 25 questions. Marking was positive since the number of correct answers to be selected out of four possibilities was indicated. Since some questions had either one, two or a maximum of three possible correct answers, the marking was weighted by assigning scores for correct answers.

A total of 23 participants sat for the pre-tests and 22 participants for post test questions on the first and last days of the course, respectively. One participant (Malaysia) was unable to complete the post-test due to ill health. Results of the test are showed in Table 4a and 4b. Theoretical pre and post test results show a 4.5% increase in scores for 25 multiple test questions.

Table 4a
Pre- and post-test results of participants (theoretical)
1st MVSE, 2018

BIL	NAME	Country	Pre Score	Post Score	%	Remarks	Level (passing mark is 50% or 13 marks)
1	Leni Tupang Thomas	Malaysia	19	-	-	Did not do post test due to Fever and went to health clinic on the last/post test day	-
2	Mr. Cheng Liang	China	19	24	26.32	↑	PASS
3	Noor Aslinda Ummi binti Awang Besar	Malaysia	19	23	21.05	↑	PASS
4	Mr. Charles Butafa	Solomon Island	19	23	21.05	↑	PASS
5	Norzihan binti Mohamed Hassan	Malaysia	21	23	9.52	↑	PASS
6	Mr. Van Dung Nguyen	Vietnam	21	23	9.52	↑	PASS
7	Dr. Rungarun Tisgratog	Thailand	23	23	0.00	↔	PASS
8	Mrs. Mao Sokny	Cambodia	17	22	29.41	↑	PASS
9	Nor Alina binti Mohd Alwi	Malaysia	20	22	10.00	↑	PASS
10	Mr. Mohd Maher bin Ibrahim	Malaysia	20	22	10.00	↑	PASS
11	Mr Dipak Kumar Sah	Nepal	20	22	10.00	↑	PASS
12	Mrs. Minh Trang Dao	Vietnam	20	22	10.00	↑	PASS
13	Mr. John Fiel Porto	Philippines	22	22	0.00	↔	PASS
14	Mr. Rezal bin Bohari	Malaysia	24	22	-8.33	↓	PASS
15	Mr. HM Al-Amin	Bangladesh	25	22	-12.00	↓	PASS
16	Wan Norqariatul Akidah binti Wan Abdullah	Malaysia	20	21	5.00	↑	PASS
17	Mr Guy Emil	Vanuatu	12	19	58.33	↑	PASS
18	Ms. Kanitta Pankeaw	Thailand	13	19	46.15	↑	PASS
19	Mr.Khalilur Rahman	Bangladesh	19	19	0.00	↔	PASS
20	Mr. Vanna Mean	Cambodia	17	18	5.88	↑	PASS
21	Dr Lee Wook Gyo	RO Korea	18	18	0.00	↔	PASS
22	Ms Amna Nasir	Pakisatan	18	18	0.00	↔	PASS
23	Mr. Yeshey Dorji	Bhutan	17	16	-5.88	↓	PASS

Using all the team resources: In most groups, it was observed that different participants have special knowledge and skills which were useful to the group as a whole and useful for completion of the tasks and for the teams' objectives.

Practical tests: Pre-test basic knowledge on adults and larvae of different mosquito genera, including *Anopheles*: only 6 out of 23 trainees passed (if 50% correct answers were used as passing marks). Also some trainees were not able to identify the genus *Anopheles* adult and larvae, and to separate them from other mosquito genera. This test result shows that even though some participants have 10-25 years of experience working on mosquitoes, their knowledge on basic mosquito taxonomy and identifications is insufficient to conduct effective vector surveillance, control and management.

Posttest practical results (*Anopheles* adults and larvae only, including known malaria vector species): As shown in table 4b, 21 out of 23 trainees passed (if 50% correct answers were used as passing marks). The test result shows that overall the trainees improved their knowledge and skills

on identifying mosquito specimens (including known vector species) that they may encounter when they return to their home countries. All trainees were able to correctly recognize *Anopheles* larvae and adult mosquitoes, and were confident enough to distinguish them from other mosquito genera that are non-malaria vectors. All trainees were observed to be highly motivated as well as having strong desire to learn about mosquito morphology and how to use appropriate ID keys (both printed/dichotomous keys and computerized interactive WRBU lucid ID keys). Even though the trainees voluntarily stayed long hours (1800-2300) on other nights when possible (depending on hotel time permit) to key out *Anopheles* mosquito species, the number of days devoted to taxonomy and identification was so limited for the trainees to learn more about identifying vectors, particularly those belonging to other mosquito genera. Too many things to learn within those short periods of time!

Table 4b
Pre- and post-test results of participants (Practical Session with Dr. Rueda)
1st MVSE, 2018

BIL	NAME	Country	Pre Score	Post Score	%	Remarks	Level (passing mark is 50%)
1	Dr. Rungarun Tisgratog	Thailand	80	100	25.00	↑	PASS
2	Mr. Van Dung Nguyen	Vietnam	40	99	147.50	↑	PASS
3	Mr. HM Al-Amin	Bangladesh	35	99	182.86	↑	PASS
4	Norzihan binti Mohamed Hassan	Malaysia	40	94	135.00	↑	PASS
5	Mrs. Minh Trang Dao	Vietnam	50	86	72.00	↑	PASS
6	Mr. Vanna Mean	Cambodia	5	81	1520.00	↑	PASS
7	Leni Tupang Thomas	Malaysia	40	79	97.50	↑	PASS
8	Mr.Khalilur Rahman	Bangladesh	50	78	56.00	↑	PASS
9	Mr. Rezal bin Bohari	Malaysia	45	77	71.11	↑	PASS
10	Mr Dipak Kumar Sah	Nepal	20	75	275.00	↑	PASS
11	Mrs. Mao Sokny	Cambodia	30	69	130.00	↑	PASS
12	Mr. Cheng Liang	China	5	69	1280.00	↑	PASS
13	Noor Aslinda Ummi binti Awang Besar	Malaysia	25	69	176.00	↑	PASS
14	Ms. Kanitta Pankeaw	Thailand	40	61	52.50	↑	PASS
15	Nor Alina binti Mohd Alwi	Malaysia	60	59	-1.67	↓	PASS
16	Mr. Mohd Maher bin Ibrahim	Malaysia	30	59	96.67	↑	PASS
17	Mr. Yeshey Dorji	Bhutan	0	57	100.00	↑	PASS
18	Mr Guy Emil	Vanuatu	5	54	980.00	↑	PASS
19	Ms Amna Nasir	Pakisatan	5	53	960.00	↑	PASS
20	Mr. John Fiel Porto	Philippines	45	52	15.56	↑	PASS
21	Mr. Charles Butafa	Solomon Island	0	51	100.00	↑	PASS
22	Wan Norqariatul Akidah binti Wan Abdullah	Malaysia	30	40	33.33	↑	
23	Dr Lee Wook Gyo	RO Korea	50	33	-34.00	↓	
	Note : Ranking based on result of Post Test						

8.2 Course Evaluation – Annex 3

Twenty-two of the twenty three participants responded to the course evaluation given at the end of the course. Secretariat also used Google form format to get the feedback from the participants. The evaluation

was categorized to 5 scores; from '1' –Very Dissatissfied, '2' – Dissatissfied, '3' – Average, '4' – Satisfied and '5' – Very Satisfied and the participants were given space to write down their comments for every questions listed. The evaluation form link is https://goo.gl/tGhNLJ with the analysis attached as Annex 3.

9. Summary and Conclusion

The 1st International MVSE course was successfully conducted on 18th to 28th November 2018 in Bentong, Pahang and Klang, Selangor Malaysia. A total of 23 participants from 13 countries namely Malaysia, Korea, China, Bhutan, Nepal, Bangladesh, Pakistan, Vietnam, Cambodia, Thailand, Philippines, Vanuatu and Solomon Island had attended this course.

The support provided by Ministry of Health at the national, state and district level as well as the support provided by ACTMalaria, APMEN and WHO was adequate enough to strengthen the infrastructure in conducting the training course more successfully. Overall, the objectives of this course have been achieved emphasizing on the need to further enhance the knowledge and skills of entomologists to assist their country towards achievement of their goal of malaria elimination

Training duration and content was an issue given the considerable amount of lectures and practicals delivered as indicated in the comments from some of the participants. It is hoped that the course would be an "eye opener" for the trainees about the importance of appropriate knowledge on every aspect of malaria entomology as it relates to the control of the vectors, particularly accurate identifications of vectors and monitoring and evaluating impact of applied measures; and that the knowledge and skills gained would be relayed by the trainees to their colleagues and other personnel in their home countries/programme.

Some of the course contents are ambitious and may not be relevant for achieving the objectives of future courses. With a wide range of backgrounds in participants from nursing, academia and research institutes, laboratory, environmental health, junior and senior programme staff, it was difficult to measure everyone with the same criteria.

Future training courses should take into account NMCP capacity as weaker countries would need individual country training or training could be delivered at least in 3 groups, viz GMS countries including Myanmar, Bangladesh, Nepal (excluding Thailand), then other Southeast Asian countries (Thailand, Malaysia, China, Philippines, Timor Leste, DPRK and ROK) and the 3rd group of Pacific countries (Papua New Guinea, Solomon Islands, Vanuatu).

Training of field entomologists and technicians who have responsibility for planning, implementation, monitoring and evaluation of malaria vector control activities at national and district levels should focus on one and/or two specific topics such as expansion of entomological surveillance and accurate morphological identification of dominant, secondary or emerging vectors.

Language was an issue but could be managed by inviting translators/interpreters and providing relevant reading material in the learner's guide well in advance so as to facilitate the participants to come prepared for a particular session.

10. Recommendations

The recommendations emerging from the feedback received from participants themselves and post-session discussion with tutors and facilitators include:

9.1 The organizers should conduct follow-up training course(s) on "Improving vector identification skills and knowledge on mosquito taxonomy" over 2-3 weeks for three regions that are in the control phase or have elimination targets by 2030. These countries are: a) the Greater Mekong Subregion including Myanmar, Bangladesh, Nepal, but excluding Thailand; b) other Southeast Asian countries: Thailand, Malaysia, China, Philippines, Timor Leste, DPRK and ROK) and c) Pacific countries: Papua New Guinea, Solomon Islands, Vanuatu). Countries in these regions are characterised by Dirus, Minimus and Maculatus complexes, Annularis, Funestus, Barbirostris, Hyrcanus, Punctulatus groups and emerging "secondary" vectors within each of these groups. The objectives are to: a) ensure national program staff in the eliminating countries are trained in techniques for voucher specimen preservation and best practice field preservation of mosquito specimens. This capacity building exercise will also be used to acquire fresh link-reared specimens for the development of the keys and molecular species confirmation; b) to expand entomological monitoring, beginning with accurate morphological identification in view of a great variety of "secondary vectors" suspected to be involved in focal malaria transmission; c) to use vector maps and receptivity as a decision making tool for prevention of reintroduction of malaria.

9.2 For countries with specific elimination targets, the organizers (APMEN, ACTMalaria and WHO) should conduct a followup course on "Strengthening entomological surveillance for focus investigations, preliminary surveys, routine or trend observations, spot checks, to inform vector control planning and implementation". Capacity building activities will include but not limited to: a) problem solving; b) characterizing receptivity to guide stratification and selection of interventions; c) tracking the relative density of malaria vector species (and their bionomics); d) tracking insecticide resistance as a basis for choosing insecticides; e) identifying other threats to the effectiveness of vector control; and f) monitoring vector control intervention coverage and quality to identify gaps and opportunities.

9.3 In the WHO Malaria Entomology and vector control guide for tutors and participants, Learning Unit 4 is inappropriate for Asia-Pacific region as it based on an entomological study of *An gambiae* and *An pharoensis* in Ethiopia during the early stages of the country's malaria eradication programme in the 1960s. WHO and/or the organizers should revise Learning Unit 4 and adapt it to reflect residual malaria transmission and exophilic and early biting vectors common in the Greater Mekong subregion (http://vbd-environment.org/residual-malaria-transmission-in-thailand-and-vietnam) and Papua New Guinea (http://vbd-environment.org/papua-new-guinea-study). The purpose is to make Learning Unit 4 relevant, stimulating and contextual in the Asia-Pacific region by tasking participants to estimate the magnitude of residual malaria transmission and factors contributing to low (<1% prevalence) but sustained transmission in different ecological settings despite high LLIN coverage. As materials for these lessons are advanced, the tutor may prefer to demonstrate or describe the examples rather than having them carried out by the participants. Some of the results of the study have been re-analysed in the light of current knowledge and new control tools, and these could be used to illustrate how entomological information is used for vector control.

9.4 In future courses, the organizers should ensure that participants come with all relevant data for situation analysis, as it is necessary while carrying out small group (country) exercises. Examples are current or historical data of parasitological and entomological surveillance data coupled with direct observations/interviews on LLIN ownership, access, usage and sleeping times in different ecological settings.

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Other references (pdfs) in CD and printed copy of the course handout (given to each trainee of the course), in addition to access to WRBU websites):

- Printed copy of "Mosquito Identification Keys , Reference Hands Out for Mosquito Vector Surveillance Course 2018", compiled by L.M. Rueda, containing about 100 pages of selected references, including mosquito generic keys, *Anopheles* identification keys for series, groups and species, and various protocols for mosquito processing, mounting, shipping, rearing, mosquito collection maintenance and curation. This printed copy was provided to each IMVSEC trainee.
- CD containing pdfs of more than 35 mosquito references (including above references), with complete journal articles on mosquito taxonomy, identification keys, protocols, etc. This CD was provided to each IMVSEC trainee.
- WRBU websites, such as www.wrbu.org containing computerized integrated identification keys, taxonomy, morphology, updated mosquito catalogs, and related information about Asian mosquitoes, including *Anopheles* species and groups, and www.vectormap.org containing VectorMap containing information on geographical distribution of various species of mosquitoes, their predicted distribution.

12. Acknowledgements

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- Selangor State Health Department
- Malacca State Health Department
- Negeri Sembilan State Health Department
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- Bentong District Health Office, Pahang
- Vector Borne Disease Sector, Ministry of Health Malaysia
- MVSE course curriculum development committees, speakers, instructors, facilitators, and participants for their contributions.

13. Budget – Annex 4

Annex 1

DATE	TIME	AGENDA
VENUE: BENTONG, PAHANG **DATE: 18th – 23rd NOVEMBER 2018**		
18th Nov 2018 Sunday	1400 - 1500	**Arrival In Bentong**
	1500 - 1700	**Check in**
	1700 - 1730	Tea Break
	1900 - 2000	Dinner
19th Nov 2018 Monday **(Day 1)**	0800 - 0945	**Opening Ceremony** - Officiate by Vector Borne-Disease Head Sector
	0945 - 1000	Group Photograph
	1000 -1030	Tea Break

	1030 - 1130	**Pre-test**
	1130-1230	Module 1: Introduction **1.1 Introduction to the WHO e-learning module on MEVC** Speaker : Mr. Rogelio Mendoza, ACTMalaria
	1230 – 1315	Module 1: Introduction **1.2 Role of Entomological Surveillance in Elimination Programmes (WHO)** Speaker : Dr. Matt Shortus, WHO-Lao PDR
	1315-1400	Lunch
	1400 - 1700	**Visit to Bentong District Health Office** Head Delegate: Vector Borne Disease Head Sector
	1700-1800	Return to Hotel
	1900 - 2000	Dinner
	2000 - 2200	**Self-study using WHO e-learning module**
20th Nov 2018 Tuesday **(Day 2)**	0800 - 0900	Module 1: Introduction **1.3 Vector control Response in Elimination; Management of Insecticide Resistance (WHO)** Speaker : Dr. Matt Shortus, WHO Representatives
	0900 - 1000	Module 1: Introduction **1.4 Malaria Elimination Programme** Speaker : Dr Rose Nani Mudin
	1000 - 1030	Tea Break
	1030 - 1130	Module 1: Introduction **1.5 Bionomics of Dominant Vectors in Asia Pacific** Speaker : Dr Jeffrey Hii
	1130-1230	Module 2: Sampling of malaria vectors **2.0 Sampling techniques (including the transport, preservation and storage)** Speaker :Dr. Leopoldo Rueda
	1300 - 1400	Lunch
	1400 - 1630	Module 2: Sampling of malaria vectors **2.1 Briefing/ preparation for the adult mosquito collection (1 h in hotel)** **- Recording and Reporting** **- Use of GPS or smart phone with GPS** Speaker :Dr. Leopoldo Rueda Facilitator : Dr. Jeffrey Hii, Mr. Kamilan (Selangor), Mr. Topek (NVBCP), Mdm Norjaiza (Kelantan), Mr. Mazlan (Pahang), Mr. Mohd Hisyamudin (Negeri Sembilan), Mr Azahari (IMR) & Mr Shakirudin (IMR)

	1630 - 1700	Tea Break
	1700 - 1715	**Travel to Kg Janda Baik**
	1715-2200	Module 2: Sampling of malaria vectors **2.2 Night Adult mosquito collection; Spot mapping/ GPS** Speaker :Dr. Leopoldo Rueda Facilitator: Dr. Jeffrey Hii, Mr. Kamilan (Selangor), Mr. Topek (NVBCP), Mdm Norjaiza (Kelantan), Mr. Mazlan (Pahang), Mr. Mohd Hisyamudin (Negeri Sembilan), Mr Azahari (IMR) & Mr Shakirudin (IMR)
21th Nov 2018 Wednesday **(Day 3)**	0730-0815	Module 2: Sampling of malaria vectors **2.3 Larval Sampling/ Mapping** Speaker : Dr. Leopoldo Rueda Facilitator : Dr. Jeffrey Hii, Mr. Kamilan (Selangor), Mr. Topek (NVBCP), Mdm Norjaiza (Kelantan), Mr. Mazlan (Pahang), Mr. Mohd Hisyamudin (Negeri Sembilan), Mr Azahari (IMR) & Mr Shakirudin (IMR)
	0815 - 0830	**Travel to Kg Sum Sum**
	0830 - 1100	Module 2: Sampling of malaria vectors **Practical** - **Larval Sampling/ Mapping** Speaker : Dr. Leopoldo Rueda Facilitator : Dr. Jeffrey Hii, Mr. Kamilan (Selangor), Mr. Topek (NVBCP), Mdm Norjaiza (Kelantan), Mr. Mazlan (Pahang), Mr. Mohd Hisyamudin (Negeri Sembilan), Mr Azahari (IMR) & Mr Shakirudin (IMR)
	1100 - 1115	Return to Hotel
	1115 - 1145	Tea Break
21th Nov 2018 Wednesday **(Day 3)**	1145 - 1230	Module 2: Sampling of malaria vectors **Practical** - **Sample Processing** Speaker : Dr. Leopoldo Rueda Facilitator : Dr. Jeffrey Hii, Mr. Kamilan (Selangor), Mr. Topek (NVBCP), Mdm Norjaiza (Kelantan), Mr. Mazlan (Pahang), Mr. Mohd Hisyamudin (Negeri Sembilan), Mr Azahari (IMR) & Mr Shakirudin (IMR)
	1230 - 1400	Lunch
	1400-1700	Module 2: Sampling of malaria vectors **2.4 Identification of Adult** Speaker : Dr. Leopoldo Rueda Facilitator : Dr. Jeffrey Hii, Mr. Kamilan (Selangor), Mr. Topek (NVBCP), Mdm Norjaiza (Kelantan), Mr. Mazlan (Pahang), Mr. Mohd Hisyamudin (Negeri Sembilan), Mr Azahari (IMR) & Mr Shakirudin (IMR)

	1700-1730	Tea Break
	1730 - 1900	Module 2: Sampling of malaria vectors **Practical** - **Processing of Field Collection (Adult- Gravid for egglaying; Larvae - preserved in 70% EoH)** Speaker : Dr. Leopoldo Rueda Facilitator : Dr. Jeffrey Hii, Mr. Kamilan (Selangor), Mr. Topek (NVBCP), Mdm Norjaiza (Kelantan), Mr. Mazlan (Pahang), Mr. Mohd Hisyamudin (Negeri Sembilan), Mr Azahari (IMR) & Mr Shakirudin (IMR)
	1900-2000	Special Dinner
22nd Nov 2018 **Thursday** **(Day 4)**	0800 - 1030	Module 3: Surveillance, monitoring and Evaluation of vector control **3.0 Monitoring and Evaluation of VC including Indicators** Speaker : Dr Jeffrey Hii
	1030 - 1045	Tea Break
	1045 - 1100	**Travel to Kg OA Hulu Chemperoh**
	1100 - 1300	Module 3: Surveillance, monitoring and Evaluation of vector control **3.1 Cone bioassays (Wall and Net)** Speaker : Dr Jeffrey Hii Facilitators : Mr. Kamilan, Mdm Nor Jaiza (Kelantan), Ms Perada Wilson Putit (NVBCP), Mr. Topek (NVBCP), Mr. Mazlan (Pahang) & Mr. Mohd Hisyamudin (Negeri Sembilan), Mr Azahari (IMR) & Mr Shakirudin (IMR)
	1300 - 1315	Return to Hotel
	1315 - 1430	Lunch
	1430 - 1730	Module 2: Sampling of malaria vectors **2.5 Identification of Larvae** Speaker :Dr. Leopoldo Rueda Facilitator : Dr. Jeffrey Hii, Mr. Kamilan (Selangor), Mr. Topek (NVBCP), Mdm Norjaiza (Kelantan), Mr. Mazlan (Pahang), Mr. Mohd Hisyamudin (Negeri Sembilan), Mr Azahari (IMR) & Mr Shakirudin (IMR)
	1730 - 1800	Tea Break
	1900 - 2000	Dinner
	2000 - 2200	Module 3: Surveillance, monitoring and Evaluation of vector control **Practical** - **LLIN Durability Monitoring** Speaker : Dr Jeffrey Hii Facilitators : Mdm Nor Jaiza (Kelantan), Ms Perada Wilson Putit (NVBCP), Mr. Topek (NVBCP) and Mr Mazlan (Pahang)

23rd Nov 2018 **Friday (Day 5)**	0800 - 1000	Module 2: Sampling of Malaria vectors **2.6 Prepare (unknown) specimens for transport** Speaker :Dr. Leopoldo Rueda Facilitator : Dr. Jeffrey Hii, Mr. Kamilan (Selangor), Mr. Topek (NVBCP), Mdm Norjaiza (Kelantan), Mr. Mazlan (Pahang), Mr. Mohd Hisyamudin (Negeri Sembilan), Mr Azahari (IMR) & Mr Shakirudin (IMR)
	1000 - 1030	Tea Break
	1030-1200	Module 3: Surveillance, monitoring and Evaluation of vector control **Practical** - **Result Interpretation** - **24 H Reading; Analysis, Recording and reporting of results** Speaker : Dr Jeffrey Hii Facilitators : Mr. Kamilan, Mdm Nor Jaiza (Kelantan), Ms Perada Wilson Putit (NVBCP), Mr. Topek (NVBCP), Mr. Mazlan (Pahang) & Mr. Mohd Hisyamudin (Negeri Sembilan)
	1200-1230	**Check out**
	1230 - 1400	Lunch
	1400 - 1600	**Travel to Shah Alam**
	1600 - 1630	**Check in at Premiere Hotel, Klang**
	1630 - 1700	Tea Break
	1900 - 2000	Dinner
VENUE: VECTOR LAB, SELANGOR DATE: 24th – 27th NOVEMBER 2018		
24th Nov 2018 **Saturday (Day 6)**	0800 - 0830	**Travel to Vector Lab**
	0830-1000	Module 2: Sampling of Malaria vectors **Practical** - **Identification of Adult and mounting (field collection: 5 adult unknown species)** Speaker : Dr Leopoldo Rueda Facilitators : Dr. Jeffrey Hii, Mr. Kamilan (Selangor), Mdm Aszlina (Selangor), Mdm. Safnatul Salisa (NVBCP), Mr. Mohd Hisyamudin (Negeri Sembilan), Mr. Mazlan (Pahang), Mr Azahari (IMR) & Mr Shakirudin (IMR)
	1000 - 1030	Tea Break

	1030 - 1230	Module 2: Sampling of Malaria vectors **Continue Practical** - **Identification of Adult and mounting (field collection)** Speaker : Dr Leopoldo Rueda Facilitators : Dr. Jeffrey Hii, Mr. Kamilan (Selangor), Mdm Aszlina (Selangor), Mdm. Safnatul Salisa (NVBCP) and Mr. Mohd Hisyamudin (Negeri Sembilan), Mr Azahari (IMR) & Mr Shakirudin (IMR)
	1230 - 1400	Lunch
	1400 - 1600	Module 2: Sampling of Malaria vectors **Practical** - **Identification of Larvae and mounting (field collection: 5 larvae unknown species)** Speaker : Dr Leopoldo Rueda Facilitators : Dr. Jeffrey Hii, Mr. Kamilan (Selangor), Mdm Aszlina (Selangor), Mdm. Safnatul Salisa (NVBCP), Mr. Mohd Hisyamudin (Negeri Sembilan), Mr. Mazlan (Pahang), Mr Azahari (IMR) & Mr Shakirudin (IMR)
	1600 - 1630	Tea Break
	1630-1730	Module 2: Sampling of Malaria vectors **Continue Practical** - **Identification of Larvae and mounting (field collection: 5 larvae unknown species)** Speaker : Dr Leopoldo Rueda Facilitators : Dr. Jeffrey Hii, Mr. Kamilan (Selangor), Mdm Aszlina (Selangor), Mdm. Safnatul Salisa (NVBCP), Mr. Mohd Hisyamudin (Negeri Sembilan), Mr. Mazlan (Pahang), Mr Azahari (IMR) & Mr Shakirudin (IMR)
	1730 - 1800	***Submission of collections and specimens to Dr. Leopoldo Rueda***
	1800 - 1900	Return to Hotel
	1900 - 2000	**Official Dinner**
25th Nov 2018 **Sunday** **(Day 7)**	0800-0830	**Travel to Vector Lab**
	0830-0930	Module 4: Insecticide Resistance Monitoring **4.0 WHO test procedures for IRM in malaria vector mosquitoes** Speaker : Dr Adeline Chan (CDC Atlanta) and Mdm. Rafidah Ali (IMR/NVBDCP)
	0930 - 1000	Module 4: Insecticide Resistance Monitoring **4.1 Preparation Of CDC bottle assay** Speaker : Dr Adeline Chan (CDC Atlanta) and Mdm. Rafidah Ali (IMR/NVBDCP) Facilitators : Mr. Kamilan (Selangor), Mdm Sharifah Milkah (NPHL), Ms Perada Wilson (NVBDCP), Mdm Rosilawati (IMR), Mdm. Fadzillah (Melaka) and Mdm. Aszlina (Selangor)

	1000-1030	Tea Break
	1030-1230	Module 4: Insecticide Resistance Monitoring **4.2 Susceptibility tests with discriminating concentration** Speaker : Dr Adeline Chan (CDC Atlanta) and Mdm Rafidah Ali (IMR/NVBDCP) Facilitators : Mr. Kamilan (Selangor), Mdm Sharifah Milkah (NPHL), Ms Perada Wilson (NVBDCP), Mdm Rosilawati (IMR), Mdm. Fadzillah (Melaka) and Mdm. Aszlina (Selangor)
	1230-1400	Lunch
	1400-1530	Module 4: Insecticide Resistance Monitoring **4.3 IR Monitoring Synergist- insecticide bioassays as a proxy for metabolic resistance mechanisms** Speaker : Dr Adeline Chan (CDC Atlanta) & Mdm Rafidah Ali (IMR/NVBDCP) Facilitators : Mr. Kamilan (Selangor), Mdm Sharifah Milkah (NPHL), Ms Perada Wilson (NVBDCP), Mdm Rosilawati (IMR), Mdm. Fadzillah (Melaka) and Mdm. Aszlina (Selangor)
	1530 - 1600	Module 4: Insecticide Resistance Monitoring **4.4 CDC bottle assay** Speaker : Dr Adeline Chan (CDC Atlanta) & Mdm Rafidah Ali (IMR/NVBDCP)
	1600-1630	Tea Break
	1630-1730	Module 4: Insecticide Resistance Monitoring **Practical - CDC bottle assay** Speaker : Dr Adeline Chan (CDC Atlanta) & Mdm Rafidah Ali (IMR/NVBDCP) Facilitators : Mr. Kamilan (Selangor), Mdm Sharifah Milkah (NPHL), Ms Perada Wilson (NVBDCP), Mdm Rosilawati (IMR), Mdm. Fadzillah (Melaka) and Mdm. Aszlina (Selangor)
	1730 -1800	Return to Hotel
	1900 - 2000	Dinner
26th Nov 2018 **Monday** **(Day 8)**	0800-0900	**Travel to Vector Lab**
	0900-1000	Module 3: Surveillance, monitoring and Evaluation of vector control **IR WMR form for IR reporting to WHO** Speaker : Matt Shortus, WHO Representatives
	1000-1030	Tea Break

	1030-1230	Module 4: Insecticide Resistance Monitoring **4.5 Insecticide Resistance Monitoring – WHO Test Tube with discriminating concentration (24H reading & Data analysis)** Speaker : Dr Adeline Chan (CDC Atlanta) & Mdm Rafidah Ali (IMR/NVBDCP) Facilitators : Mr. Kamilan (Selangor), Mdm Sharifah Milkah (NPHL), Ms Perada Wilson (NVBDCP), Mdm Rosilawati (IMR), Mdm. Fadzillah (Melaka) and Mdm. Aszlina (Selangor)
	1230-1400	Lunch
	1400-1600	Module 4: Insecticide Resistance Monitoring **4.6 Insecticide Resistance Monitoring - Synergist insecticide bioassays (24H reading & Data intepretation/ analysis)** Speaker : Dr Adeline Chan (CDC Atlanta) & Mdm Rafidah Ali (IMR/NVBDCP) Facilitators : Mr. Kamilan (Selangor), Mdm Sharifah Milkah (NPHL), Ms Perada Wilson (NVBDCP), Mdm Rosilawati (IMR), Mdm. Fadzillah (Melaka) and Mdm. Aszlina (Selangor)
	1600-1730	Module 4: Insecticide Resistance Monitoring **4.7 Insecticide Resistance Monitoring – CDC bottle assay (24H reading & data analysis)** Speaker : Dr Adeline Chan (CDC Atlanta) & Mdm Rafidah Ali (IMR/NVBDCP) Facilitators : Mr. Kamilan (Selangor), Mdm Sharifah Milkah (NPHL), Ms Perada Wilson (NVBDCP), Mdm Rosilawati (IMR), Mdm. Fadzillah (Melaka) and Mdm. Aszlina (Selangor)
	1730-1800	Tea Break
	1800 - 1830	Return to Hotel
	1900 - 2200	**Welcome Dinner Officiate by Head of Vector Borne Disease Sector**
27th Nov 2018 **Tuesday** **(Day 9)**	0800-0930	**Travel to IMR, Kuala Lumpur**
	0930-1030	Module 5: Colonization of Anopheles Mosquito **5.0 Insectary criteria and management** Speaker : Dr Nazni Wasi Ahmad (IMR) Facilitator : Mdm Wan Najdah Wan Mohd Ali (IMR)
	1030-1100	Tea Break
	1100 - 1300	Module 5: Colonization of Anopheles Mosquito **5.1 Method of Anopheles rearing and colony** Speaker : Dr Rohani Ahmad (IMR) Facilitator : Mdm Wan Najdah Wan Mohd Ali (IMR) Mr. Ahmad Fakhriy Hassan (IMR)
	1300 - 1400	Lunch

	1400 - 1500	Module 5: Colonization of Anopheles Mosquito **5.2 Forced mating (insemination/ artificial mating) method** Speaker : Dr Rohani Ahmad (IMR) Facilitator : Mdm Wan Najdah Wan Mohd Ali (IMR) Mr. Ahmad Fakhriy Hassan (IMR)
	1500 - 1630	**Visit to Wolbachia Laboratory, Institute Medical Research (IMR), Jalan Pahang, Kuala Lumpur**
	1630 - 1730	Return to Hotel
	1900 - 2000	Dinner
	2000 - 2200	Self Study
28th Nov 2018 **Wednesday** **(Day 10)**	0800-1000	**Post-test** **Course Evaluation** **Panel Discussion**
	1000-1030	Tea Break
	1030-1200	**Closing Ceremony** - **Officiate by Deputy Director-General of Health (Public Health)**
	1200 - 1230	Check out
	1230-1400	Lunch

Annex 2

MVSE Course 2018

The 1st International Malaria Vector Surveillance for Elimination Course 2018

* Required

1. **Name** *

2. **Email** *

Part I -True of False: Tick True if the statement is true and False if otherwise.

Directions: Read carefully and follow the instructions in each part

3. **1. A blood-meal is necessary for maturation of the mosquito's eggs**

Mark only one oval.

- ◯ True
- ◯ False

4. **2. The main aim of entomological surveillance is to gather baseline data for planning anti-vector measures**

Mark only one oval.

- ◯ True
- ◯ False

5. **3. All anopheline species can be distinguished by their external morphology**

Mark only one oval.

- ◯ True
- ◯ False

6. **4. When transporting adult mosquitoes and mosquito larvae, you must avoid undue shaking of the container**

Mark only one oval.

- ◯ True
- ◯ False

7. **5. The resistance or susceptibility of Anopheles mosquitoes to insecticides should be determined before IRS**

Mark only one oval.

- ◯ True
- ◯ False

8. **6. For focus investigations, entomologists conduct entomological investigations in areas of new, persistent or resurgent malaria transmission and to determine why the interventions being used are no longer reducing transmission**
Mark only one oval.

- ◯ True
- ◯ False

9. **7. When the cases are indigenous or introduced and intervention coverage is high and/or there is limited entomological information, an entomological investigation should be conducted to determine the vector species involved, its susceptibility to the insecticides used for vector control and the relevant vector bionomics**
Mark only one oval.

- ◯ True
- ◯ False

10. **8. Routine entomological surveillance and/or spot checks are not useful in areas of high receptivity and/or high vulnerability and in areas where the risk of re-establishment is significant**
Mark only one oval.

- ◯ True
- ◯ False

The table below shows 5 scenarios and actions (Surveillance response) that could be guided by entomological, vector control and other information.

9. Scenario: Increase in vector abundance (or reports of biting) not due to seasonality
Surveillance Response: Check intervention coverage. Check intervention quality. Determine vector composition (and
behaviour if possible). Assess insecticide resistance

10. Scenario: Vector habitats are being significantly altered by changes in land use or other environmental changes (e.g.
flooding, development).
Surveillance Response: Assess vector species composition (and behaviour if possible).

11. **The answer for the question 9:**
Mark only one oval.

- ◯ True
- ◯ False

12. **The answer for the question 10:**
Mark only one oval.

- ◯ True
- ◯ False

13. **11. It is not necessary to take pre-emptive actions to mitigate insecticide resistance before resistance becomes stable in the vector population**
Mark only one oval.

- ◯ True
- ◯ False

14. **12. Insecticide resistance can occur at low levels, gradually increasing in frequency in a vector population without being detected, until a tipping-point is reached where resistance can increase rapidly**
Mark only one oval.

- ◯ True
- ◯ False

15. **13. The discriminating or diagnostic concentration is a combination of amount of insecticide and exposure time to discriminate the susceptible from resistant phenotypes in an vector population**
Mark only one oval.

- ◯ True
- ◯ False

16. **14. The discriminating concentration measures the strength of insecticide resistance in a vector population**
Mark only one oval.

- ◯ True
- ◯ False

17. **15. Cross-resistance is when resistance to one insecticide by a mechanism also confers resistance to insecticides another class**
Mark only one oval.

- ◯ True
- ◯ False

Part II- Multiple Choice: Tick the letter of the correct answer

18. **16. How long does development of sporozoites generally take in a mosquito?** *
Mark only one oval.

- ◯ b. 5 days
- ◯ c. 8-15 days
- ◯ d. 5-23 days
- ◯ a. 0-5 days

19. **17. Which mosquitoes are the most dangerous for humans** *
Mark only one oval.

- ◯ b. Zoophagic
- ◯ a. Anthropophagic

20. **18. Which mosquitoes are captured in exit and windows traps?** *
Mark only one oval.

- ◯ a. Exophagic and endophilic
- ◯ b. Endophagic and exophilic

21. **19. What does the term "source reduction" refer to in malaria vector control?** *
Mark only one oval.

- ◯ b. Any measure to prevent the breeding of mosquitoes or elimination of their breeding sites
- ◯ c. Any measure to reduce the number of mosquitoes
- ◯ a. The reduction of human and material resources for planned malaria vector control activities

22. **20. What type of test is used to measure percentage mortality after exposure of vectors to a standard diagnostic dose of insecticide?** *
Mark only one oval.

- ◯ b. Biochemical and immunological assays
- ◯ a. Susceptibility test
- ◯ c. Molecular test

23. **21. Vectorial capacity is defined as:** *
Mark only one oval.

- ◯ b. The capability for disease transmission by a vector to a host, population density, host preference, feeding habits or frequency, and longevity.
- ◯ d. The efficiency of vector mosquitoes to invade and colonize new habitats and non-endemic areas.
- ◯ a. The reproductive capacity of vector mosquitoes which includes mating, host seeking and oviposition behaviours
- ◯ c. The adaptability of vector mosquitoes to different ecological conditions.

24. **22. Anopheles species complexes are:** *
Mark only one oval.

- ◯ a. Morphologically dissimilar species
- ◯ d. Efficient and Insecticide-resistant mosquitoes
- ◯ c. Physiologically competent mosquitoes
- ◯ b. Morphologically similar species, e.g. sibling or isomorphic species

25. **23. Techniques used in the identification of Anopheles species complexes are:** *
Mark only one oval.

- ◯ b. Cytogenetics, e.g. polytene chromosomes
- ◯ e. All of the above
- ◯ c. Morphology of adults, larvae and pupae
- ◯ d. Molecular tools such as polymerase chain reaction (PCR)
- ◯ a. Crossing (or hybridization) experiments

26. **24. The parity of mosquitoes is:** *
Mark only one oval.

- c. The number of times that a female has given birth to an offspring
- d. The number of bites per person per month
- b. The number of ovipositions by a female mosquito
- a. The number of times that a male mosquito feeds on plant nectar

27. **25. Residual malaria transmission is:** *
Mark only one oval.

- c. The transmission that persists due to health system deficiencies such as stockouts of antimalarial drugs, rapid diagnostic test kits and health care services
- b. The transmission that persists due to insecticide resistance despite high coverage of ITN/LLIN and IRS
- d. The transmission that persists due to increased exposure of people to infective mosquito bites
- a. The transmission that persists once universal coverage of ITN/LLIN and/or maximal IRS coverage has been achieved