THE WORLD HEALTH ORGANIZATION (WHO-HQ)

THE REGIONAL OFFICE FOR THE EUROPEAN REGION (EURO)

&

THE INSTITUT DE RECHERCHE POUR LE DEVELOPPEMENT (IRD)

&

THE WORLDWIDE INSECTICIDE RESISTANCE NETWORK (WIN)

Organized

THE 1st EUROPEAN WORKSHOP ON TESTING PROCEDURES FOR MONITORING AND MANAGING INSECTICIDE RESISTANCE IN INVASIVE MOSQUITOES

18 – 22 NOVEMBER 2019

Convened by :

The Institut de Recherche pour le Développement (IRD)
911 Avenue Agropolis, Montpellier
FRANCE

1. Context

With increasing travel and trade, several invasive *Aedes* mosquitoes (*Ae. albopictus, Ae. japonicus, Ae. aegypti*) have been recently introduced in European countries, where they represent a major nuisance and an actual health threat due to the capacity to transmit exotic arboviruses [1, 2]. *Aedes albopictus* have already been responsible for Chikungunya outbreaks in Italy [3] and autochthonous cases of dengue and chikungunya in southern France [4]. Moreover, *Culex pipiens* is also widespread in Europe, where it represents the main vector of West Nile Virus. Preventing diseases caused by currently recognized or novel mosquito-borne viruses continues to depend largely on controlling vector populations. In Europe, larvicides are largely used to reduce mosquito abundance, while spraying of pyrethroid insecticides in and around autochthonous arbovirus cases is the only measure recommended to stop transmission. Evidence of reduced susceptibility to insecticides has been recently reported in *Cx. pipiens* and *Ae. albopictus* populations from Italy [5, 6], Greece [7], and Spain [8], but no regular resistance monitoring is carried out at national level which makes prioritization for vector control difficult.

In view of the spread of insecticide resistance in invasive mosquitoes in Europe and the lack of expertise and capacity to conduct routine resistance monitoring at national level, the WHO and IRD through the WIN initiative (https://win-network.ird.fr/) will jointly organize the 1st workshop on testing procedures for monitoring and managing insecticide resistance at IRD, Montpellier, France. The scope is to build a regional information base on mosquito vectors susceptibility to insecticides on which rational resistance management policy and locally effective vector control can be based in the member states.

2. Objectives

The workshop aims to strengthen the capacity of European countries at risk of mosquito transmitted diseases to conduct appropriate monitoring and surveillance of insecticide resistance. **The workshop will provide participants with necessary knowledge and practical skills to conduct basic resistance tests following standardized WHO methodologies and reporting/analysis system.** The output of the meeting is to provide participants with sufficient expertise and knowledge to conduct insecticide resistance tests needed to support decision making for vector control and good management practices.

3. Content

The workshop will consist of a certain number of lectures on vector biology, control and insecticide resistance and technical presentations on WHO procedures for testing insecticide products; a visit to the Vectopole, a WHO collaborating platform for testing public health insecticides; demonstrations of the calculation and preparation of insecticide materials (papers, stock solutions, bottle coating, etc); use of the WHO test kits, larval bioassays and bottle assay tests and; data analysis and depository. An evaluation will be implemented at the end of the training to assess the knowledge acquired by participants (theoretical and practical). Scoring will be based on the three following categories (A = knowledge acquired, B = knowledge being acquired, C = unearned knowledge).

4. Programme

Please refer to Annex 1.

5. Duration

The workshop will last for 1 week from 18-22 November 2019.

6. Targeted audience

Permanent institutions or health programs of the Government who are committed to carry on with the tests regularly. The idea is to ensure that participants will have the capacity to build and sustain resistance monitoring activities in their respective countries. A selection committee will be in charge of evaluating the pertinence of the applications.

7. Registration

If you are interested in participating to the training, register at https://forms.gle/secKh4n26WyXhSJu6, before October 20, 2019.

8. Other information

Travel, accommodation and local meeting costs will be arranged and covered by the workshop organizers. Candidates must provide i) an Health insurance certificate and ii) a Liability insurance certificate in order to participate in this event.

9. References

1. Medlock JM, Hansford KM, Versteirt V, Cull B, Kampen H, Fontenille D, Hendrickx G, Zeller H, Van Bortel W, Schaffner F: **An entomological review of invasive mosquitoes in Europe**. *Bull Entomol Res* 2015, **105**(6):637-663.
2. Tomasello D, Schlagenhauf P: **Chikungunya and dengue autochthonous cases in Europe, 2007-2012**. *Travel Med Infect Dis* 2013, **11**(5):274-284.
3. Rezza G, Nicoletti L, Angelini R, Romi R, Finarelli AC, Panning M, Cordioli P, Fortuna C, Boros S, Magurano F *et al*: **Infection with chikungunya virus in Italy: an outbreak in a temperate region**. *Lancet* 2007, **370**(9602):1840-1846.
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5. Pichler V, Malandruccolo C, Serini P, Bellini R, Severini F, Toma L, Di Luca M, Montarsi F, Ballardini M, Manica M *et al*: **Phenotypic and genotypic pyrethroid resistance of Aedes albopictus, with focus on the 2017 chikungunya outbreak in Italy**. *Pest Manag Sci* 2019.
6. Kasai S, Caputo B, Tsunoda T, Cuong TC, Maekawa Y, Lam-Phua SG, Pichler V, Itokawa K, Murota K, Komagata O *et al*: **First detection of a Vssc allele V1016G conferring a high level of insecticide resistance in Aedes albopictus collected from Europe (Italy) and Asia (Vietnam), 2016: a new emerging threat to controlling arboviral diseases**. *Euro Surveill* 2019, **24**(5).
7. Fotakis EA, Chaskopoulou A, Grigoraki L, Tsiamantas A, Kounadi S, Georgiou L, Vontas J: **Analysis of population structure and insecticide resistance in mosquitoes of the genus Culex, Anopheles and Aedes from different environments of Greece with a history of mosquito borne disease transmission**. *Acta Trop* 2017, **174**:29-37.
8. Bengoa M, Eritja R, Delacour S, Miranda MA, Sureda A, Lucientes J: **First Data on Resistance to Pyrethroids in Wild Populations of Aedes albopictus from Spain**. *J Am Mosq Control Assoc* 2017, **33**(3):246-249.

ANNEX 1 – Programme

THE 1st EUROPEAN WORKSHOP ON TESTING PROCEDURES FOR MONITORING AND MANAGING INSECTICIDE RESISTANCE IN INVASIVE MOSQUITOES

18-22 November 2019

IRD, 911 Avenue Agropolis, 34394 Montpellier, France

Contact persons:

Dr. Raman Velayudhan, Coordinator, WHO-NTD, VelayudhanR@who.int

Dr. Vincent Corbel, Research professor, IRD-WIN, vincent.corbel@ird.fr

Ms. Claire Durot, WIN Project manager, Claire.durot@ird.fr / winprojectoffice@ird.fr

Participants; 20 max

Lunch served between 12.30-14.00 in room 151

Morning and afternoon coffee breaks (served at different time) in room 151

Day 1: 18 November 2019

Time	Agenda	Responsible
08.00-08.30	Registration at IRD, Centre Occitanie (Amphithéâtre des plantes)	IRD-WIN (Ms. Claire Durot)
08.30-09.00	Opening session Opening remarks	Dr. Yves-Martin Prével (IRD), Director of Health department), France Dr. Fréderic Simard (IRD), Director of MIVEGEC unit, France Dr. Raman Velayudhan (WHO-NTD), coordinator of the Vector Ecology & Management unit, Switzerland
09.00-09.10	Objectives of workshop programme and expectations	Vincent Corbel (IRD), Research professor, Montpellier, France
09.10-09.30	Key note lecture on "Ecology, distribution and public health impact of invasive mosquitoes in Europe"	Dr. Vincent Robert (IRD), Research professor, Montpellier France
09.30-09.50	Key note on "New and existing methods for the control of invasive mosquitoes in Europe"	Dr. David Roiz (IRD), Research Fellow, Montpellier, France
09.50-10.10	Key note lecture on "Spread of insecticide resistance in invasive mosquitoes in Europe"	To determine
10.10-10.30	Key note lecture on "Mechanisms of insecticide resistance in *Aedes*: detection methods and geographical relevance"	Dr. David Weetman (LSTM), Reader, Liverpool, UK
10.30-10.50	Morning coffee-break (Amphithéâtre des plantes)	

10.50-11.10	Key note lecture on "Insecticide resistance management strategies applicable to *Aedes* mosquitoes"	Dr. Fabrice Chandre (IRD), Research professor, Montpellier, France
11.10-11.30	Key note lecture on "WHO testing procedures for monitoring insecticide resistance in mosquitoes"	Dr. João Pinto (IHMT),Professor, Lisbon, Portugal
11.30-11.50	Key note lecture on "Experimental design and data analysis of bioassays"	Dr. Pie Müller (Swiss Tropical Institute), Professor, Switzerland
11.50-12.10	Overall summary and discussion	Dr. Raman Velayudhan (WHO NTD) / Dr. Vincent Corbel (IRD)
12.10-12.30	Group photo	
12.30-14.00	Lunch (Room 151)	
14.00-15.00	Visit to the testing facilities (Vectopole)	Ms. Bethsabée Scheid
15.00-15.45	WHO larval bioassays – Introduction, methods and application	Mr. Stéphane Duchon
15.45-16.30	WHO filter paper test – Introduction, methods and application	Ms. Marie Rossignol
16.30-17.00	Afternoon coffee break (Room 151)	
17.00-17.45	Bottle assays – Introduction, methods and application	Ms. Céline Montazeau
17.45-18.15	Discussion and creation of working groups	Dr. Vincent Corbel / Dr. Fabrice Chandre
18.30-19.30	Cocktail at IRD	
19.30	Transport to hotel	

Day 2: 19 November 2019

Time	Group session (by group of 5)	Responsible
09.00-12.00	G1: Preparation of stock solutions and demonstration on how to conduct larval bioassays	Mr. Stéphane Duchon
09.00-12.00	G2: Demonstration on how to conduct Bottle assays and conduct Bottle assays	Ms. Marie Rossignol
09.00-12.00	G3: Demonstration on how to conduct WHO filter paper test and conduct filter paper test	Ms. Bethsabée Scheid
09.00-12.00	G4: Preparation of stock solutions and conduct impregnation of Bottles	Ms. Céline Montazeau
12.00-13.00	Lunch (Room 151)	
13.00-16.00	G1: Conduct larval bioassays	Mr. Stéphane Duchon
13.00-16.00	G2: Preparation of stock solutions and conduct impregnation of Bottles	Ms. Marie Rossignol
13.00-16.00	G3: Preparation of stock solutions and conduct impregnation of WHO filter paper test	Ms. Bethsabée Scheid
13.00-16.00	G4: Demonstration on how to conduct Bottle assays and conduct Bottle assays	Ms. Céline Montazeau
16.00-16.30	Afternoon coffee-break (Room 151)	
16.30-17.00	Discussion (Room 151)	
17.00	Transport to hotel	

Day 3: 20 November 2019

Time	Group session (by group of 5)	Responsible
09.00-12.00	G1: Preparation of stock solutions and conduct impregnation of Bottles	Mr. Stéphane Duchon
09.00-12.00	G2: Preparation of stock solutions and demonstration on how to conduct larval bioassays	Ms. Marie Rossignol
09.00-12.00	G3: Demonstration on how to conduct Bottle assays and conduct Bottle assays	Ms. Bethsabée Scheid
09.00-12.00	G4: Demonstration on how to conduct WHO filter paper test and conduct filter paper test	Ms. Céline Montazeau
12.00-13.00	Lunch (Room 151)	
13.00-16.00	G1: Demonstration on how to conduct Bottle assays and conduct Bottle assays	Mr. Stéphane Duchon
13.00-16.00	G2 : Conduct larval bioassays	Ms. Marie Rossignol
13.00-16.00	G3 : Preparation of stock solutions and conduct coating for Bottle assays	Ms. Bethsabée Scheid
13.00-16.00	G4 : Preparation of stock solutions and conduct impregnation of WHO filter paper test	Ms. Céline Montazeau
16.00-16.15	Afternoon coffee-break (Room 151)	
16.15-17.30	G1: Recording test results (larval test)	Mr. Stéphane Duchon
16.15-17.30	G2: Recording test results (bottle assays)	Ms. Marie Rossignol
16.15-17.30	G3: Recording test results (filter papers)	Ms. Bethsabée Scheid
16.15-17.30	G4: Recording test results (bottle assays)	Ms. Céline Montazeau
17.30-18.00	Discussion (Room 151)	
18.00	Transport to hotel	

Day 4: 21 November 2019

Time	Group session (by group of 5)	Responsible
09.00-12.00	G1: Demonstration on how to conduct WHO filter paper test and conduct filter paper test	Mr. Stéphane Duchon
09.00-12.00	G2: Preparation of stock solutions and conduct impregnation of WHO filter paper test	Ms. Marie Rossignol
09.00-12.00	G3: Preparation of stock solutions and demonstration on how to conduct larval bioassays	Ms. Bethsabée Scheid
09.00-12.00	G4: Preparation of stock solutions and demonstration on how to conduct larval bioassays	Ms. Céline Montazeau
12.00-13.00	Lunch (Room 151)	
13.00-16.00	G1: Preparation of stock solutions and conduct impregnation of WHO filter paper test	Mr. Stéphane Duchon
13.00-16.00	G2 : Demonstration on how to conduct WHO filter paper test and conduct filter paper test	Ms. Marie Rossignol
13.00-16.00	G3 : Conduct larval bioassays	Ms. Bethsabée Scheid
13.00-16.00	G4 : Conduct larval bioassays	Ms. Céline Montazeau
16.00-16.15	Afternoon coffee-break (Room 151)	
16.15-17.30	G1: Recording test results (bottle assays)	Mr. Stéphane Duchon
16.15-17.30	G2: Recording test results (larval test)	Ms. Marie Rossignol
16.15-17.30	G3: Recording test results (bottle assays)	Ms. Bethsabée Scheid
16.15-17.30	G4: Recording test results (filter papers)	Ms. Céline Montazeau
17.30-18.00	Discussion	
18.00	Transport to hotel	

Day 5: 22 November 2019

Time	Agenda	Responsible
09.00-10.30	G1: Recording test results (filter papers)	Mr. Stéphane Duchon
09.00-10.30	G2: Recording test results (filter papers)	Ms. Marie Rossignol
09.00-10.30	G3: Recording test results (larval test)	Ms. Bethsabée Scheid
09.00-10.30	G4: Recording test results (larval test)	Ms. Céline Montazeau
10.30-11.00	Coffee-break (Room 151)	
11.00-12.30	Data analysis, depository and management (Room 151)	All group
12.30-14.00	Lunch (Room 151)	
14.00-15.00	MCQ exam (Room 151)	All group
15.00-15.30	Afternoon coffee-break (Room 151)	
15.30-16.00	Results of exam and graduation ceremony	Dr. Vincent Corbel / Dr. Fabrice Chandre/ Dr. Raman Velayudhan
16.00-16.30	Closing ceremony	Dr. Yves-Martin Prével / Dr. Fréderic Simard
16.30	Transport to hotel	