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Heterogeneity of the susceptibility status of *Anopheles gambiae sl* to insecticides commonly used for malaria control in Kinshasa, Democratic Republic of Congo

J. Zanga[1,2], E. Metelo[1,3], Y. Tshisungu[1], K. Mbanzulu[2], N. Basosila[4], G. Kiyombo[1], R. Wumba[2], S. Irish[5], P. Mansiangi[1]

- [1]Laboratoire de Bio-écologie et Lutte Antivectorielle du Département de Santé-Environnement de l'Ecole de Santé Publique/Faculté de Médecine, Université de Kinshasa/RDC; [2]Département de Médecine Tropicale, Faculté de Médecine, Université de Kinshasa/RDC; [3]Faculté de Médecine, Université de Bandundu/RDC; [4]Programme National de Lutte contre le Paludisme, Ministère de Santé Publique/RDC, Entomology Branch , [5]Division of Parasitic Diseases and Malaria, Center for Global Health, CDC-Atlanta/USA.

Correspondance: Paul Mansiagi Mankadi, pmansiangi@gmail.com

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Background

The use of insecticide-treated mosquito nets is the main malaria prevention strategy in DRC. Its implementation in our country during the last decade can increase the resistance of the vectors to the insecticides used and compromise its effectiveness. The entomological monitoring with collection of data on the sensitivity of vectors to the usual insecticides is one of the pillars of The insecticide resistance management . To date, no study has been conducted simultaneously on several sites throughout the city of Kinshasa. This study was conducted to describe the distribution of *Anopheles gambiae sl* sensitivity across the city of Kinshasa.

Methods

The larvae and nymphs of *Anopheles gambiae sl* were harvested in 5 sites throughout the city of Kinshasa. Their insecticide resistance levels were measured with WHO susceptibility tests using insecticides from four chemical classes, especially: Permethrin (0.75%), Deltamethrin (0.5%), DDT (4%), Bendiocarb (0.1 %) and Malathion (5%). In case of proven resistance to pyrethroids, the tests were performed by pre-exposing mosquitoes to piperonyl butoxide (PBO). The effectiveness of these insecticides was determined by their knockdown effect for 60 minutes and the mortality observed after 24 hours according to the WHO criteria. A sample of *Anopheles gambiae sl* were randomly selected for molecular identification and screened for knockdown resistance (kdr) by PCR.

Results

In all the identified larval gites of the different sites, 3684 *Anopheles gambiae sl* larvae and nymphs were collected. Molecular identification of 60 female mosquitoes selected revealed the presence of 2 species: *An. gambiae s.s* (98.3%) and *An. coluzzi* (1.7%).

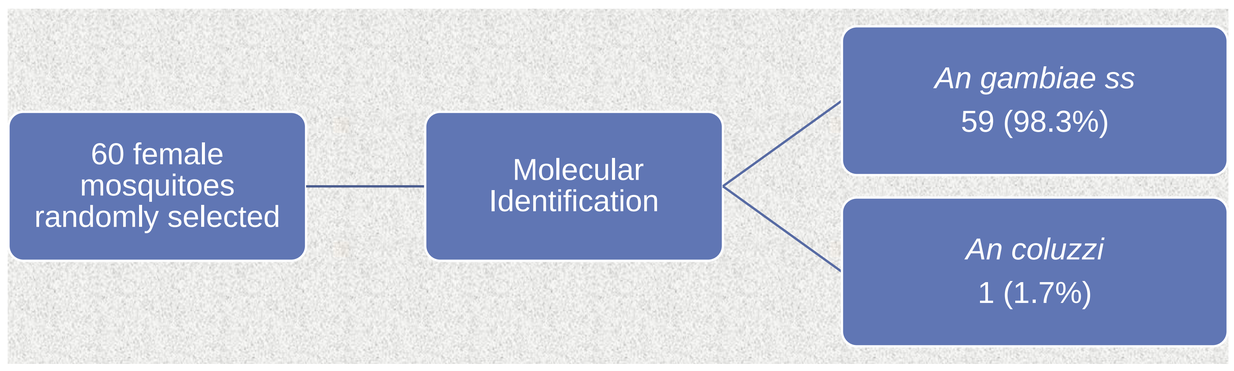

Table 1. Mortality after 24h (M%) and insecticide resistance status (IRS) of An. gambiae sl in Kinshasa city

Insecticides	Kimbangu (n=100)		Kintambo (n=100)		Limete (n=100)		Maluku (n=100)		POSTER NUMBER : C 115 (n=100)	
	M%	IRS	M%	IRS	M%	IRS	M%	IRS	M%	IRS
Deltamethrin 0,05 %	99	S	62	R	62	R	64	R	99	S
Deltamethrin 0,05 % + PBO 5%	-	-	100	S	99	S	98	S	-	-
Permethrin 0,75 %	79	R	36	R	36	R	21	R	45	R
Permethrin 0,75 % + PBO 5 %	98	S	96	R	86	R	41	R	100	S
Bendiocarb 0,1 %	100	S	100	S	100	S	100	S	100	S
Malathion 5%	100	S	100	S	100	S	100	S	100	S
DDT 4 %	10	R	7	R	12	R	9	R	2	R

- ✓ Variability of Deltamethrin *An. gambiae sl* resistance status by site (Resistant in 3 sites and Sensitive in 2 sites); Restoration of susceptibility after pre-exposure to PBO
- ✓ Resistance to Permethrin in all sites ; Partial restoration of susceptibility after pre-exposure to PBO (Only in 2 sites)
- ✓ Susceptibility to Bendiocarb and Malathion in all sites
- ✓ Resistance to DDT in all sites

- ✓ Only West African (L1014F) kdr allele was detected
- ✓ Variability of Allelic frequency of L1014 F Kdr gene: Very high (0.95 or 1.0) in the sites where *An gambiae sl* is resistant to pyrethrinoids (Kintambo, Limete and Maluku) and none in the sites where their sensitivity was observed (Mont Ngafula)
- ✓No Ace1 mutation has been detected

Table 2. Genotype of L1014F Kdr of *An. gambiae ss* from Kinshasa

Kdr allele (L1014F)	Kimbangu (n=12)	Kintambo (n=12)	Limete (n=11)	Maluku (n=12)	Mt Ngafula (n=12)
ss	-	0	0	0	12
Rs	-	0	1	0	0
RR	-	12	10	12	0
F(kdr)	-	1.0	0.95	1.0	0.0

Discussion and Conclusion

A clear predominance of *An. gambiae ss* compared to *An. Coluzzi* is observed in this city. This finding was also reported by Jacob M Riveron (1). The heterogeneity of the insecticide resistance status of *An. gambiae ss* can be explained by the variability environmental conditions of Kinshasa city and the large scale use of LLINs for a decade. Mosquito Nets treated with a mixture of Deltamethrin with a synergist (PBO) constitute an important alternative.

The presence of kdr genes and the fact that the sensitivity of An gambiae has been improved after pre-exposure to PBO suggests that both metabolic and target-site mutation mechanisms are contributing to insecticide resistance (2). The lack of Knockdown effect on DDT and permethrin is due to the presence of the high frequency kdr mutation in this megacity (3). Further studies on this issue would probably help to control the occurrence of insecticide resistance in this environment.

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