



First report of insecticide resistance in *Anopheles gambiae sensu lato* from Sahel eastern Chad, central Africa

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ABSTRACT

Objective: Malaria is the main driver of sickness and death in Chad. To facilitate pre-elimination efforts in the Sahel region, researchers characterized the composition of anopheline species and their role in malaria transmission, examined the *Anopheles gambiae sensu lato* (*An. gambiae s.l.*) population in eastern Chad, and investigated the insecticide resistance status of field populations.

Methodology and results: Anopheline larvae were collected from sampling sites located in eastern Chad and reared in an insectary. Emerging *An. gambiae s.l.* adults were sorted to assess insecticides resistance profile using WHO tube assays. Overall 395 female mosquitoes collected by Pyrethrum spray catches, *An. gambiae s.l.* was the predominant, followed by *An. rufipes*, *An. squamosus* and *An. pharoensis*. ELISA detection revealed a low *Plasmodium falciparum* infection rate. Bioassays were carried out with adult female *An. gambiae s.l.* revealed resistance to pyrethroids and DDT (dichlorodiphenyltrichloroethane) and susceptibility to malathion and carbamates. TaqMan detected 1014F *kdr* mutation in *An. gambiae s.l.* at lower frequency.

Conclusion and application of findings: Vector control is the cornerstone of malaria control/elimination agenda, but information on molecular basis of insecticide resistance in the major malaria vectors *An. gambiae s.l.* from Sahel eastern Chad is grossly lacking. Such data underpin evidence-based vector control and resistance management. Here, we established the role of a major malaria *An. gambiae s.l.* from Sahel eastern Chad in malaria transmission. The results showing pyrethroid and DDT resistance in *An. gambiae s.l.* from eastern Chad highlight challenge associated with deployment of malaria control tools using pyrethroid bed nets and indoor residual spraying with DDT in the Sahel area of this country. Organophosphate and carbamate insecticides could be alternative for control strategies in this locality given their full susceptibility. Switching current DDT-IRS to organophosphate and carbamate-based IRS using such as pirimiphos-methyl for organophosphate or bendiocarb for carbamates appears as a promising alternative. For LLINs, priority should be given to dual-AI nets incorporating either pyrethroid plus PBO or pyrethroid

plus chlorfenapyr. Rotation across insecticide classes for organophosphate and carbamate should be performed annually for IRS in order to main effectiveness of control strategies and break potential emerging resistance. Mosquito susceptibility and molecular characterization of target mutation should be monitored each semester. Moreover, larval source management, housing improvements, and strict safety measures to prevent human toxicity should complement current interventions.

Keywords: *Anopheles gambiae* s.l., Malaria, Insecticide Resistance, Biltine, Chad.