

Could insecticide-treated cattle reduce Afrotropical malaria transmission? Effects of deltamethrin-treated Zebu on *Anopheles arabiensis* behaviour and survival in Ethiopia

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Abstract. *Anopheles arabiensis* Patton (Diptera: Culicidae) is the most widespread vector of malaria in the Afrotropical Region. Because *An. arabiensis* feeds readily on cattle as well as humans, the insecticide-treatment of cattle – as employed to control tsetse (Diptera: Glossinidae) and ticks (Acari: Ixodidae) – might simultaneously affect the malaria vectorial capacity of this mosquito. Therefore, we conducted field experiments in southern Ethiopia to establish whether Zebu cattle (*Bos indicus* L.) treated with a pour-on pyrethroid formulation of 1% deltamethrin, widely used to control ticks and tsetse, would be effective against *An. arabiensis* or cause the female mosquitoes to feed more frequently on humans, due to behavioural avoidance of insecticide-treated cattle. Contact bioassays (3 min exposure) showed that the insecticide remained effective for about 1 month (kill rate > 50%) against mosquitoes feeding on the flanks of treated cattle. A novel behavioural assay demonstrated that *An. arabiensis* readily fed on insecticide-treated cattle and were not deflected to human hosts in the presence of treated cattle. DNA-fingerprinting of bloodmeals revealed that *An. arabiensis* naturally feeds most frequently on older animals, consistent with the established practice of applying insecticide only to older cattle, while allowing younger untreated animals to gain immunity against infections transmitted by ticks. These encouraging results were tempered by finding that > 90% of *An. arabiensis*, *An. pharoensis* and *An. tenebrosus* females feed on the legs of cattle, farthest from the site of pour-on application along the animal's back and where the treatment may be least residual due to weathering. Observations of mosquitoes feeding naturally on insecticide-treated cattle showed that the majority of wild female anophelines alighted on the host animal for less than 1 min to feed, with significantly shorter mean duration of feeding bouts on insecticide-treated animals, and the effective life of the insecticide was only 1 week. Thus the monthly application of deltamethrin to cattle, typically used to control tsetse and ticks, is unlikely to be effective against *An. arabiensis* populations or their vectorial capacity. Even so, it seems likely that far greater impact on anopheline mosquitoes could be achieved by applying insecticide selectively to the legs of cattle.

Key words. *Anopheles arabiensis*, *Bos indicus*, bioassay, blood-feeding, cattle, deltamethrin, insecticide-treated cattle, livestock, malaria vector, mosquito behaviour, pyrethroids, repellency, vector control, vectorial capacity, Zebu, Ethiopia.