

PhD defence Adam Hendy

Blackfly ecology and *Onchocerca volvulus* transmission in three formerly hyperendemic foci in Uganda, Tanzania and Cameroon

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University of Antwerp - Antwerpen

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Dit is de omschrijving



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Supervisors

- Prof. dr. Dirk Berkvens (ITM)
- Prof. dr. Jean-Claude Dujardin (University of Antwerp)

Summary

Human onchocerciasis or 'river blindness' is a chronic and debilitating disease caused by infection with *Onchocerca volvulus*, a parasitic worm transmitted by riverine-breeding *Simulium* species blackflies. Mass drug administration through annual community directed treatment with ivermectin (CDTI) is the primary method of controlling the disease in sub-Saharan Africa, where an estimated 25.7 million cases occur. However, ivermectin only temporarily sterilises adult worms and must be administered for the reproductive lifespan of the parasite to effectively suppress transmission. The World Health Organization (WHO) aims to eliminate onchocerciasis by 2025, but whether elimination can be achieved through annual CDTI alone is unknown. This thesis presents a study of blackflies and *O. volvulus* transmission in three formerly hyperendemic foci, where control is through annual CDTI alone, or biannual CDTI plus vector control.

Investigations were conducted in onchocerciasis foci in Uganda (Madi-Mid North), Tanzania (Mahenge) and Cameroon (Mbam Valley). Breeding site surveys and adult blackfly collections were made in each focus to identify the human biting (anthropophilic) species and rates of parasite transmission. Anthropophilic *S. damnosum* s.l. and *S. bovis* were collected in low numbers in Uganda where biannual CDTI plus vector control has taken place since 2012. However, *O. volvulus* was not detected in any of the <1,000 flies screened for infection. *Simulium damnosum* s.l. comprised >99% of ≈17,000 anthropophilic blackflies collected in Tanzania, where an estimated 0.57% (95% CI 0.43% – 0.74%) carried transmissible parasites. Infection rates in Tanzania appeared similar to pre-control levels, despite annual CDTI commencing in 1997. In Cameroon, *S. damnosum* s.l. was the exclusive anthropophilic species and screening a sample of >90,000 blackflies showed that unacceptable levels of *O. volvulus* transmission were continuing to occur after 16 years of annual CDTI. In addition, a side-project evaluating the efficacy of the 'Esperanza Window Trap' as an alternative to human bait for the collection of anthropophilic blackflies, showed it to be effective for the collection of *S. damnosum* s.l. in Uganda, but not in Tanzania. Results indicate a need for further research and development before traps are widely used for surveillance of parasite transmission.

In conclusion, while blackfly collections in Uganda were insufficient to demonstrate interruption of *O. volvulus* transmission according to WHO guidelines, results are encouraging for the use of integrated approaches to disease control. In Tanzania and Cameroon, unacceptable levels of transmission are continuing to occur, and annual CDTI alone may be insufficient to achieve widespread elimination of onchocerciasis.

Please confirm your attendance by sending an email to ahendy@itg.be .