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The effect of transfluthrin-treated jute and cotton emanator vests on human landing and fecundity of *Anopheles minimus* in Thailand

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ABSTRACT

Complementary approaches to tackle outdoor and early evening biting mosquitoes are urgently required. Transfluthrin (TFT) is a volatile pyrethroid capable of altering mosquito feeding behavior. This study investigated the efficacy of TFT-treated jute (TFT-J) and cotton (TFT-C) fabrics on human landing activity, feeding and fecundity of *Anopheles minimus* in Thailand. Jute and cotton fabrics each measuring 1024 cm^2 were impregnated with 7.34×10^{-4} g/cm^2 TFT (20%, w/v), and evaluated in a semi-field screen house system. Two collectors, wearing an untreated control or TFT-treated vests, conducted human-landing collections of released 100 laboratory-reared adult females of *An. minimus* from 18:00–00:00 h for 16 consecutive nights. Recaptured mosquitoes were given a blood meal for 30 min. with a membrane feeding system for assessment of blood feeding and fecundity. TFT-J, relative to control, significantly reduced human landings (Odds Ratio (OR) =0.27 (95% Confidence Interval (CI) [0.10–0.74], $p = 0.011$)), however no significant reduction was observed for TFT-C (OR=0.67 [95% CI 0.24–1.82], $p = 0.43$). Blood feeding was significantly lower among mosquitoes exposed to TFT-J (12.45% [95% CI, 2.04–22.85], $p = 0.029$) and TFT-C (13% [95% CI, 0.99–26.84], $p = 0.016$) relative to control. Impregnated fabrics had no effect on the mean number of egg oviposition. However, egg hatchability was reduced in TFT-J (49.5% [95% CI, 21.74–77.26], $p = 0.029$) and TFT-C (40.2% [95% CI, 17.21–63.19], $p = 0.008$) relative to control. TFT-J significantly reduced the landing, blood feeding, and fertility of *An. minimus*. Further studies are needed to evaluate different treatment methods on fabrics and their incorporation in integrated mosquito management.

1. Background

The Greater Mekong Subregion (GMS) in southeast Asia has experienced dramatic declines in malaria transmission, with reported *Plasmodium falciparum* indigenous cases falling by 93%, while all malaria indigenous cases fell by 78% between 2020 and 2022 (WHO, 2021). The rate of decline has been fastest since 2012 when the GMS Malaria Elimination program was implemented which resulted in 84 and 93% decline in malaria cases and deaths, respectively, between 2012 and 2017 (WHO, 2015a, 2022a). Short-term regional goals included the interruption of *P. falciparum* transmission in areas with multidrug resistant *Plasmodium* parasites by no later than 2020 and in all areas of the GMS by 2025, and the elimination of malaria across the region by 2030 (WHO, 2015a). Multidrug-resistant malaria parasites threaten the regional goal for malaria elimination (Amaratunga et al., 2016; Ashley et al., 2014) among unprotected mobile and migrant populations such as forest-goers and security personnel (Guyant et al., 2015; WHO, 2015) and increase the risk of residual transmission (Bannister-Tyrrell et al., 2019; Edwards et al., 2019; Hii and Rueda, 2013; Killeen, 2014).

Most of the gains in controlling malaria transmission observed between 2012 and 2017 were attributed to indoor vector control interventions such as long-lasting insecticide treated nets (LLINs) and indoor residual spraying (IRS) (WHO, 2022b). Whilst LLINs and IRS are effective against malaria vectors that feed and rest indoors, they are less effective against outdoor-biting (WHO, 2015b) and insecticide resistant (Fettene et al., 2013) malaria vectors, thereby contributing to residual malaria transmission (Durnez and Coosemans, 2013; Sherrard-Smith et al., 2019). It is estimated that the fraction of indoor *Anopheles* bites for

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