

## Repellent properties of various essential oils and synthetic and natural products against *Culicoides nubeculosus* and *C. obsoletus* (Diptera: Ceratopogonidae), vectors of Orbivirus

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Control of animal arbovirus transmission by *Culicoides* biting midges vectors is almost exclusively performed using pour-on pyrethroid insecticides on ruminants. Alternative strategies to synthetic insecticides, such as repellent essential oils, should be developed. Biting midges were exposed to various essential oils (geranium, lavender, lemongrass, lemon-eucalyptus, peppermint, tea tree), other natural (Neem) or synthetic (DEET) repellents, and deltamethrin diluted in ethanol. The tests were performed by applying the products to the membrane of an artificial blood-feeding unit (Hemotek) for laboratory-reared *C. nubeculosus* and a sugar solution for *C. obsoletus*, due to unsuccessful engorgement on the feeding unit of wild caught individuals. Blood-feeding on ethanol-treated control was about 70% for *C. nubeculosus*. Immediately following application, DEET at 5 and 20%, lemongrass (*Cymbopogon citratus*) and geranium (*Pelargonium asperum*) at 5% were consistently superior to the other products at repelling *C. nubeculosus* from blood-feeding. Two hours after application, the blood-feeding inhibition of most of the products declined sharply. DEET and deltamethrin caused significant mortality compared to the control. For field collected *C. obsoletus*, engorgement on sugar solution was variable but usually ranged from 40 to 50% for the control. DEET, lemongrass and geranium repelled 100% of the biting midges from sugar feeding for one hour. Mortality was significant for DEET, deltamethrin and lemongrass. The effective dose to protection was determined for lemongrass, geranium and deltamethrin.