# Human-Biting Activity, Resting Behavior and Yellow Fever Virus Transmission Potential of *Aedes* Mosquitoes in Southwest Ethiopia

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## **Abstract**

Yellow fever (YF) is an emerging and re-emerging arboviral disease transmitted through the bites of infected *Aedes* mosquitoes, primarily in the genus *Aedes*. Several outbreaks of yellow fever have been documented in southern Ethiopia. Four outbreaks have been documented since 2012, suggesting that southern Ethiopia is prone to YF outbreaks. Understanding the transmission cycle is pivotal to managing arboviral disease outbreaks, and the aims of the present study were to investigate the mosquito species that most likely contributed to the recent YF outbreaks and to study their behaviors. Therefore, the present study aimed to evaluate which species of *Aedes* mosquitoes contribute to the YF virus transmission, the outbreaks that have occurred and their behaviors (biting and resting) in the region. Two districts were selected on the basis of recent YF outbreak history. A longitudinal entomological survey was conducted to collect adult mosquitoes by using human landing catches (HLC), mechanical mouth aspirators and pyrethrum sprays. Collections were conducted twice a month for six months, from February 2019 to July 2020. The mosquitoes were identified by species by using morphological keys and molecular techniques. A total of 1689 mosquitoes were collected, of which 93.7% (1582/1689) were members of the genus *Aedes* and 6.3% (107/1689) of the genus *Culex*. A total of 58.7% (991/1689) of the mosquitoes were captured in the Ofa District and 41.3% (698/1689) from the Boko Dawula District. The largest number of mosquitoes, 97.9% (1653/1689), were collected during the wet season. A total of 1582 members of the *Aedes simpsoni* complex were collected, where 57.7% (913/1582) were from the Ofa District and 42.3% (669/1582) were from the Boko Dawula District. Molecular identification showed that members of the *Aedes simpsoni* complex accounted for 99.5% (404/406), while *Aedes aegypti*, detected only in the Ofa District, accounted for only 0.5% (2/406). The mosquitoes were pooled and tested for YFV, dengue virus (DENV, serotype 1–4) and chikungunya virus (CHKV) by using qPCR. None of the 934 *Aedes simpsoni* tested were positive for any arboviruses. The human-biting activities of *Ae. simpsoni* complex were peaked between 8:00–9:00 and 16:00–17:00, mostly outdoors, both within the villages and the forests. The largest numbers of *Aedes simpsoni* complex resting mosquitoes were collected from the leaves of the Abyssinian banana, Ensete ventricosum, suggesting that they are the preferred resting places. Although the tested *Ae. simpsoni* complex was negative for arboviruses; the morning and afternoon activities of the species complex coincide with peak human outdoor activities in these areas and may therefore pose the highest risk of transmitting YFV to humans. The extremely low abundance of *Aedes aegypti* suggests a minor role in arbovirus transmission in southern Ethiopia. It is of great importance that expanded surveillance activities of arboviruses to include reservoir hosts and sylvatic vectors to the chances of devising and implementing effective control measures.

**Keywords:**

[***Aedes***](https://www.mdpi.com/search?q=Aedes); [**mosquitoes**](https://www.mdpi.com/search?q=mosquitoes); [**yellow fever**](https://www.mdpi.com/search?q=yellow+fever); ***[simpsoni](https://www.mdpi.com/search?q=simpsoni+complex)*[complex](https://www.mdpi.com/search?q=simpsoni+complex)**; **[behavior](https://www.mdpi.com/search?q=behavior)**; **[southwestern Ethiopia](https://www.mdpi.com/search?q=southwestern+Ethiopia)**