Simplified Pupal Surveys of Aedes aegypti (L.) for Entomologic Surveillance and Dengue Control [1]

Submitted on 29 June 2009 - 10:54pm

Calificación:

By Dr. Roberto Barrera, CDC ARTICLE EXCERPT Pupal demographic surveys of Aedes aegypti (L.) are based on the assumption that pupal productivity (pupae per person per unit of time) is a better proxy for adult productivity than traditional indices (house, container, and breteau) or larval count.1 Pupal populations of Ae. aegypti are highly correlated with the number of larvae and adults, and pupal counts can be used to estimate absolute pupal population density (e.g., pupae per hectare).2–4 However, determining the absolute population density of Ae. aegypti adults is more challenging; thus far, only experiments that mark, release, and recapture adult mosquitoes can provide such estimates. Female mosquito density has been shown to be related to human density and to entomologic transmission thresholds (i.e., the minimum number of mosquitoes required for dengue transmission, expressed in such terms as pupae/person).5 Entomologic thresholds are higher with lower ambient temperatures and greater herd immunity; thus, thresholds vary. This study uses entomologic thresholds based on a mosquito simulation model (CIMSiM) and a dengue simulation model (DENSiM) described previously.5 These models suggest that if dengue-infected persons are introduced into a community of susceptible individuals, an epidemic will not emerge unless a minimum number of mosquitoes (i.e., a threshold) are present to carry out dengue virus transmission. An epidemic is defined as a 10%

increase of dengue seroprevalence within a year. The main purpose of this study was to develop and assess two approaches for simplifying the assessment of dengue vector populations by means of pupal demographic surveys. The first method attempted to find a generalized statistical model that describes the distribution of Ae. aegypti pupae and that is valid for most pupal surveys. For this method, the task was to determine whether the statistical distributions of pupae/person could be described by a common aggregation parameter (k) of the NBD. 11 If a common k existed, a simplified sequential sampling program (SSP) based on the NBD could be developed. 12 SSPs are efficient sampling schemes used to classify the vector populations below or above the population thresholds. The theoretical pupal demographic thresholds were used to set the upper thresholds above which vector control should be applied to avoid dengue transmission.5 SSPs have been successfully applied in various mosquito studies for effective reduction of the sample size required for reliable appraisals of population levels.8 The second approach for simplifying sampling used the presence or absence of Aedes spp. pupae instead of pupae/person and thus avoided the time-consuming process of finding and counting all pupae in a sampling unit (e.g., household). Once a pupa was found in a household, the inspector could move on to a different household and take another sample. Inference was based on an empirical model of the relationship between the proportion of habitat units infested and the number of pupae per habitat unit. 13–15 This model enabled calculations of threshold proportions of infested households above which dengue transmission could occur. As before, an SSP was developed, but this one used a regular binomial distribution model for presence/absence of pupae per household.
Author’s address: Roberto Barrera, Dengue Branch, Centers for Disease Control and Prevention, Calle Canada, San Juan, Puerto Rico 00920, Tel: 787-706-2399, Fax: 787-706-2496, E-mail: rbarrera@cdc.gov [2]. Am. J. Trop. Med. Hyg., 81(1), 2009, pp. 100-107

Links
[1] https://www.cienciapr.org/en/external-news/simplified-pupal-surveys-aedes-aegypti-l-entomologic-surveillance-and-dengue-control?language=en [2] mailto:rbarrera@cdc.gov