ABSTRACT

Dengue is a vector-borne disease that lack vaccine or effective treatment, resulting in vector control being the primary disease control strategy. *Wolbachia*, an intracellular bacterium that can spread through vector population via cytoplasmic incompatibility (CI), has been shown to inhibit the transmission of a number of the deadly human diseases such as dengue, Chikungunya and filariasis through various species of mosquitoes. In order to utilize *Wolbachia* for mosquito control, a more efficient vector population suppression and replacement strategy required to block the transmission of pathogens to the humans. The main objective of the current study was to evaluate the potential of wAlbB *Wolbachia* induced in *Ae. aegypti* for population suppression followed by population replacement dynamics through various release ratios of *Wolbachia* infected males. The experimental protocol consisted of five experimental and one control group in both experiments (Suppression/Replacement). Population suppression protocol contained 1-5 experimental groups with constant (20) number of wild males and females considering in natural population. The number of *Wolbachia* infected males varied as 20, 40, 60, 80 and 100 resulting various initial frequencies of wild females to *Wolbachia* infected males (1:1, 1:2, 1:3, 1:4 and 1:5). However, in the population replacement protocol, *Wolbachia* infected females to *Wolbachia* infected males with various initial frequencies described above (1:1-1:5) were released having equal number of wild males and females in semi-field conditions. After one week of 1st release, 2nd release was conducted with the same ratios to boost up the replacement strategy. Presence of *Wolbachia* was confirmed by PCR in each successive generation using wsp *Wolbachia* specific primers. The population dynamics analysis was based on three parameters (i) Oviposition i.e. number of eggs produced, (ii) percentage of larval hatching and (iii) percentage of suppression/replacement of adult mosquitoes. The results indicated there was no significant difference ($p>0.05$) in egg laying capacity of females in experimental groups when compared with the control group in both experiments in all generations. However, significantly lowered mean percentage hatching was observed from group 1-5 compared with control group (group 6) having no *Wolbachia* infection in both population suppression and replacement experiments. In addition maximum suppression (82.81%) was observed in second generation with release ratio 1:5 indicating the highest number of *Wolbachia* infected males released caused maximum suppression of population. For population replacement, *Wolbachia* infected females caused population replacement observed in three successive generations. The maximum population replacement (80%) was observed in 3rd generation with 1:5 ratio of *Wolbachia* infected females to *Wolbachia* infected males indicating *Wolbachia* infected females triggered population replacement in the presence of maximum number of *Wolbachia* infected males. The release of maximum number of *Wolbachia* infected males in the presence of *Wolbachia* infected females can accelerate the population replacement by increasing the frequency of compatible mating and results in enhancing the *Wolbachia* infected population. The release of small number of *Wolbachia* infected females have an important role in the replacement strategy. Keeping the wild population in 1:1 ratio. In conclusion, current study indicated that wAlbB *Wolbachia* strain which is artificially transfected in *Ae. aegypti* (the major vector of dengue in Pakistan) has potential to suppress as well as capable of replacing the wild population of mosquitoes. Both population suppression and replacement are beneficial for dengue control in any endemic area, specifically those strains of *Wolbachia* which are involved in dengue virus inhibition could be used to replace the wild population. The current research require further investigation in natural field conditions and need to be supported at both community and government level for its beneficial impact of the research in society.