Several genetically modified insect strains have been created for reproductive sterility and female-specific lethality in mosquito and tephritid fruit fly pests to improve their biological control. This has been achieved using conditional lethal systems that allow organismal survival for rearing under permissive conditions, while all or females-only offspring die under non-permissive conditions. For these purposes a dominant temperature-sensitive (DTS) lethal mutation has been transformed into the Caribbean fruit fly, where 96-100% pupal lethality is achieved at elevated temperatures. In the same species a tetracycline-suppressible (Tet-Off) system has been introduced to conditionally regulate the embryonic expression of a pro-apoptotic cell death gene in both sexes, and in females specifically for males-only release programs. Development of these transgenic strains is highly encouraging for control of species devastating to agriculture and human health. But the transposon-based vectors used for their creation can result in insertional mutations making transgenic strains less fit, and their random genomic insertion make them subject to position effects that often suppress transgene expression. Transposon vectors are also subject to re-mobilization due to the unintended presence of the transposase used for genomic transformation. Thus, two critical goals of transgene vector creation for insect hosts is the development of vectors that can be targeted to pre-defined genomic insertion sites, and then, modified post-integration to stabilize the vector with respect to its transposase. For targeting, new vector systems have been created using attP, FRT and loxP recombination sites that are introduced into insect hosts by transposon-mediated transformation. Optimal target-site strains are then selected which can be modified by post-integration deletion of terminal vector sequences, resulting in stabilization of the target site. It is expected that stabilized target site strains should result in the rapid development and validation of new transgenic strains for the highly effective and ecologically safe control of pest populations.

Keywords: insect transformation, biological control, genomic transgene targeting, transgene stabilization