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RE-MATING CONSEQUENCES ON THE EFFICIENCY OF THE STERILE INSECT TECHNIQUE

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The Sterile Insect Technique (SIT) is a biological control technique based on mass-rearing, sterilization, and releases of the pest species targeted for population control. Sterile males are released to dilute wild population, so that wild females are more likely to encounter and mate with a sterile male rather than a wild male, thus reducing the number of offspring in the next generation. However, if wild females tend to re-mate, the effectiveness of SIT may be compromised.

The influence of re-mating, i.e. the ability of a female to be inseminated several times, was studied using a model based on differential equations with continuous releases. In the model, the population is structured into larvae, sterile and wild males, and three female stages: unmated, mated with sterile males, and mated with wild males. Sterile matings with sterile males produce no offspring, as opposed to fertile matings with fertile males. We compared a situation in which females mate only once in their lifetime with one in which they can mate and then re-mate after a certain period of time, called the refractory period. Situations in which the refractory periods associated with sterile and fertile matings are not equal have been studied.

The analytical study of the re-mating model revealed a dependency between the existence of infestation equilibria, limiting control capabilities where they exist, and the length of refractory periods. Thus, if the refractory period associated with sterile matings is short, larger releases are needed to control the population. If this refractory period is long, sterile matings will make females unavailable for some time, in addition to the dilution effect of the releases, thus increasing the effectiveness of SIT compared to the previous case. The study highlights the impact of reproduction processes on SIT control effectiveness, and more generally the need for a thorough understanding of the ecology and biology of the target pest.

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