



New results on the combination of Sterile Insect Technique and enthomopathogenic fungi

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Since 2017, *Bactrocera dorsalis*, the oriental fruit fly, has invaded Réunion island, causing significant damage to many crops, particularly mango orchards. It is necessary to combat this pest, using biological control methods [1].

The Sterile Insect Technique (SIT) is an old autocidal method used against pest and vectors of diseases. It is based on the releases of sterile males supposed to mate with wild females, such that the sterile-mated females will have no offspring, leading to a progressive decay of the wild population. Many SIT models have been developed taking into account that only one mating occurs. In fact, for many fruit flies species, like *Bactrocera dorsalis*, this is not the case: re-mating can occur after a certain time after the first mating. In addition, sterile males are not necessarily 100% sterile: residual fertility can occur such that sterile-mated females may deposit a certain proportion of viable eggs, ε .

In [2], we have developed a complex model to take into account these issues. In particular, we show that SIT is efficient, i.e. elimination is possible, only if $\mathcal{R}_{S\varepsilon} < 1$, where \mathcal{R}_S is the basic offspring number related to the single and double-mated sterile females. We improve the result obtained in [3].

Then, we consider SIT in combination with an enthomopathogen soil's fungi that is used to control the fruit fly at the pupae stage. We show that this combination relax the constraint on the residual fertility and also decay the critical release rate. This works is part of the AttracTIS project, funded by Ecophyto 2021-2022.

Keywords: sterile insect technique, enthomopathgen fungi, dynamical systems, monotone systems, residual fertility, re-mating, oriental fruit fly

References

- [1] L. Moquet, V. Jacob, Y. Dumont, P. F. Duyck, H. Delatte, TIS et attractif contre *Bactrocera dorsalis* à la Réunion, *Phytoma*, hal-04721445, 773:30–33, 2024.
- [2] Y. Dumont, On the improvement of the Sterile Insect Technique by Entomopathogenic Fungi: impact of residual fertility and re-mating behaviour, hal-05003793, 2025.
- [3] Y. Dumont, C. F. Oliva, On the impact of re-mating and residual fertility on the Sterile Insect Technique efficacy: Case study with the medfly, *Ceratitis capitata*, *PLOS Computational Biology*, 20:e1012052, 2024.