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Chikungunya: an unusual vector-borne disease. Overview and new research trends.

Since the huge epidemic of Chikungunya in 2006 in Réunion Island and in India, and since the small outbreak in 2007 in Italy, a few Chikungunya cases were reported in september 2010 in the south-east of France, indicating that even northern and developed countries can be affected. Since the epidemic in Réunion Island, our knowledge on the Chikungunya virus and its principal vector in Réunion Island, *Aedes albopictus*, have increased (see [6] for instance). Chikungunya is an unusual vector-borne disease. For instance, it has been proved that the virus has a strong impact on the life-span of the infected mosquitoes [6]. After some works on the modeling of the epidemic and on the efficiency of chemical vector control tools, like adulticides and larvicides, [1, 2], a new project, the SIT-project, has began in 2009. It aims to investigate the possible use of the "Pulsed" Sterile Insect Technique (P-SIT) as an alternative to insecticides, principally because mosquito can develop a resistance to insecticides and because SIT only impacts the mosquito population [3]. In particular, in [3], we show that frequent and small releases of sterile males can be efficient to control an epidemic, if it is used early after the beginning of the epidemic or as a preventive control tool.

Up to now, all published models are temporal models, i.e. they don't take into account the spatial component. Based on the previous works [1, 2], we have filled this gap by considering a Patch model that takes into account population migration between some cities in Réunion Island [1]. We compute a general Basic Reproduction Number, $\mathcal{R}_{0,G}$, related to this patch model, and show that even if locally $\mathcal{R}_0$ is less than 1, $\mathcal{R}_{0,G}$ can be greater than 1. This indicates that population displacements can globally induce an outbreak. For practical purposes, we show that vector control in some places where locally $\mathcal{R}_0$ is large, can be efficient to control "globally" the epidemic.

Finally, following the P-SIT study, we add the spatial component in the modelling of the mosquito population, which leads to a system of non linear partial differential equations [5]. The aim is to "optimize" vector control by reducing the breeding sites or/and by using the P-SIT control. We illustrate the presentation with numerical simulations.

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