

Assessing classical swine fever disease control measures using an individual-based model

Lange, M.¹, Kramer-Schadt, S.², Thulke, H.-H.¹

¹Helmholtz Centre for Environmental Research Leipzig – UFZ, Dept. of Ecological Modelling, Leipzig, Germany, martin.lange@ufz.de

²Leibniz Institute for Zoo and Wildlife Research, Alfred-Kowalke-Str. 17, D-10315 Berlin, Germany

DOI: 10.5073/jka.2011.432.113

Abstract

Classical Swine Fever (CSF) is considered an endemic disease in European wild boar populations. Huge effort is paid on oral mass vaccination against CSF virus, but few is known about the efficacy of different application schemes of the control measures in space, or in dependence of the outbreak dynamics. We used an individual-based, spatially-explicit model to assess vaccination strategies under uncertain virulence. A preventive component of vaccination was found crucial for limiting disease spread and preventing disease endemicity.

Keywords: Classical Swine Fever, disease control, epidemiological modelling, individual-based model, oral mass immunization, uncertainty, virulence

Introduction

Classical Swine Fever (CSF) is a viral disease in wild boars (*Sus scrofa*) and domestic pigs causing huge economic impact on individual farmers and national economies. The management of the disease became even more complicated in the last decades due to endemicity in wild boar populations in several European countries. Huge effort is paid on CSF control in wild boar populations by oral mass vaccination, but few is known about the efficacy of the applied measures to control or eradicate the disease. Furthermore, virulence as a crucial parameter for disease dynamics varies widely between CSF virus strains and is highly uncertain.

Methods

We implemented a spatially-explicit, individual-based wild boar population model, coupled with a CSF virus model on the level of individual traits. The model accounts for social behavior of boar groups as well as individual variations in disease outcomes. Over a range of case mortality and duration of the infectious period (the virulence), we tested alternative spatial baiting strategies. We compared these scenarios regarding the performance of the management measured by final size of the infected area and long-term persistence.

Results

Our analysis showed that artificial immunization can facilitate disease persistence under certain conditions. High success in virus eradication as well as prevention of disease spread was only possible with preventive vaccination in terms of baiting in front of the epidemic wave. Buffered vaccination effort was completely sufficient to exploit the effect of vaccination of the entire area, which translates strategic needs into a practical management plan. A buffer radius corresponding disease spread distance of one year revealed suitable to fully exploit the potential of oral mass vaccination.

Conclusions

Although preventive baiting strategies are not yet implemented in the field due to EU legislation but with marker vaccines in sight, we recommend buffered baiting of the area with infected animals.