Studies on herd-immunity and primary versus secondary infection of VHSV in challenge and vaccination trials with rainbow trout

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Studies on herd-immunity effect and primary versus secondary infection of VHSV by Ellen Lorenzen, Torben Eigil Kjær & Niels Lorenzen, National Veterinary Laboratory, Århus

The phenomenon of "herd-immunity" is one of the basal principles behind vaccination as well as selective breeding, i.e. the more non-susceptible individuals in a population, the lower the risk of disease among susceptible individuals. Thus as part of a recent field trial with a VHS-DNA-vaccine vaccinated as well as naïve fish from a Danish fish farm were brought to the laboratory at a size of 24g to be subjected to an experimental challenge with VHSV. The setup included 7 aquaria with 100 fish in each: 2 aquaria with 100 vaccinated fish (+VHS-challenge), 2 aquaria with 100 naïve fish (+ VHS-challenge), 2 aquaria with 50 vaccinated + 50 naïve fish (+VHS-challenge), and 1 aquarium with non-challenged control fish (vaccinated + naïve). Mortality in the aquaria with only vaccinated fish was 2-3 %. Mortality in the aquaria with only naïve fish was 60-70 %. However, mortality among naïve fish in the mixed aquaria was only 6-18 %, the mortality among vaccinated fish being 0-6 %, and we interpreted this as an effect of herd-immunity, where the vaccinated fish protected the naïve fish, probably by secreting less virus compared to the naïve fish. We tried to demonstrate this phenomenon in 3 later experiments, but without success, probably due to a too high challenge load in relation to the susceptibility of the fish included in these studies, i.e. it was shown that the challenged vaccinated fish secreted large amounts of virus, although still less than challenged naïve fish. However, these results led to the question if the fish die due to the challenge virus or due to the virus secreted from fish in the same aquarium that become diseased at an early time point. This question was addressed in 3 subsequent parallel challenge experiments (3 different virus doses) including only one fish in 24 aquaria and 24 fish in 3 aquaria. The study showed, that at high challenge doses, mortality was comparable in the single-fish group (24 aquaria) and the group with 24 fish in each of 3 aquaria. At lower challenge doses, however, the survival rate increased in the single fish group the lower the virus titer during challenge. i.e. at lower challenge doses, secondary infections seem more pronounced. These results will be presented and discussed.