Fighting rabbits in Australia by infection with viral strains is just a delay of the invasion

[1]Marian Proorocu, [2,3]Dragoș Oroian, [4,5]Tudor Păpuc, [1]Antonia Odagiu

[1] Department of Environmental Engineering and Protection, Faculty of Agriculture, University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca, Cluj-Napoca, Romania; [2] Faculty of Horticulture, University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca, Cluj-Napoca, Romania; [3] Faculty of Agriculture, University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca, Cluj-Napoca, Romania; [4] Faculty of Animal Sciences and Biotechnologies, University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca, Cluj-Napoca, Romania; [5] Bioflux SRL, Cluj-Napoca, Romania. Corresponding author: A. Odagiu, antonia.odagiu@usamvcluj.ro

Abstract. This paper briefly discusses the history of European rabbit biocontrol attempts by intentionally inducing epidemics in Australia. Feral rabbits in Australia pose a significant threat to biodiversity, affecting 304 endangered plant and animal species. Several epidemics were produced in feral rabbit populations, successively, in 1937-1950, 1996 and 2017. Studies for testing viruses obtained from feral rabbits carried out in the 2000's showed that the majority of these viruses were more virulent than the viruses used to initiate the epidemic. A new recovery of the feral rabbit population is expected to follow this episode. The production in the laboratory of several viral strains in addition to the strains appeared by spontaneous mutation predisposes to risks the domestic rabbits from farms, which belong to the same species, *Oryctolagus cuniculus*.
Key Words: Australia, biocontrol, hemorrhagic disease, *Oryctolagus cuniculus,* RHDV.

Introduction. The European rabbit (*Oryctolagus cuniculus*) was introduced in many parts of the world for hunting purposes (Oroian et al 2014; Petrescu-Mag 2018). This species, released into the wild in Australia, seriously affects local biodiversity (Cox et al 2019). The problems began at least a century ago (see the early rabbit barriers, Fenner 2010) (Figure 1). At the half of the last century, the Australian authorities devised a strategy to combat this pest of agriculture and biodiversity. This paper briefly discusses the history of European rabbit biocontrol attempts by intentionally inducing epidemics in Australia.

The epidemic for population control. The plan was for a very lethal virus to be released into the wild. The first infections of feral rabbits occurred successively in 1937-1950, using the myxoma virus (Fenner & Fantini 1999; Fenner 2010) (Figure 2). In several years, the rabbits adapted and recovered numerically. This was followed by a reinfection with two viral strains, myxoma and calicivirus, in 1996 (Ward et al 2010). This limited the populations of feral rabbits to about 15% of their potential numbers, but the adaptation of the immune system of these animals has made the invasion problem relevant again (Agerpres 2017).

A virus created for biological pest control, RHDV1 K5, was released in more than 600 areas of Australia in 2017 to reduce the number of feral rabbits again. This calicivirus was created in virology laboratories in South Korea to exterminate part of the rabbit population, according to the Australian edition of the Daily Telegraph (Agerpres 2017).

Authorities in the Department of Primary Industries first placed virus-free carrots in areas with a large rabbit population to attract these specimens. The following week, employees of the institution returned to the same areas to place carrots impregnated with the lethal virus (Agerpres 2017).

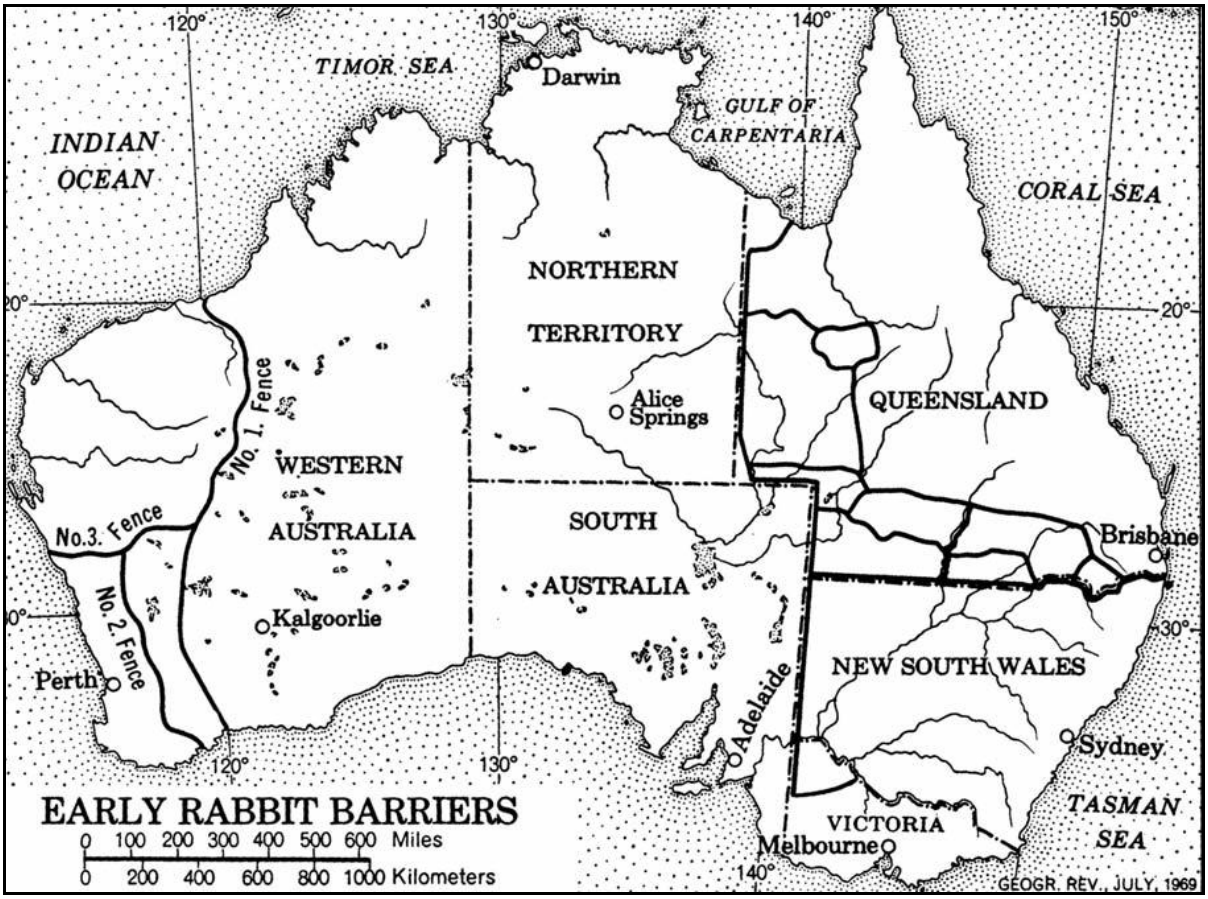

Figure 1. Barrier fences built in Australia between 1880 and 1910 (Fenner 2010).

Figure 2. Myxoma virus disease in domestic rabbits (Fenner 2010).

Results of the biocontrol plan. The researchers evaluated the effect of intentionally infecting the rabbit population in Australia for biocontrol. The impact of the release of the novel strain of rabbit hemorrhagic disease virus (RHDV-K5) has been suppressed by the emergence of a competing strain, RHDV2. Consequently, the success of further releases

of similar RHDV strains for rabbit biocontrol appears doubtful (Ramsey et al 2020). However, this competing viral strain RHDV2 has suppressed rabbit population by about 60%, with impacts mostly observed in West and Southern Australia (Ramsey et al 2020). Whether the incursion of RHDV2 leads to the competitive exclusion of other endemic RHDV strains remains to be resolved, the researchers said. The existence of partial cross-immunity could allow some level of coexistence between RHDV2 and other RHDV strains, at least on the medium term (Ramsey et al 2020).

Earlier studies for testing viruses obtained from feral rabbits carried out in 2000's showed that the majority of these viruses were more virulent than the virus used to initiate the epidemic (Fenner 2010).

Australian Deputy Prime Minister Barnaby Joyce told Canberra (Agerpres, February 27, 2017) that feral rabbits in Australia pose a significant threat to biodiversity, affecting 304 endangered plant and animal species. A new recovery of the rabbit population is expected to follow this episode.

The production in the laboratory of several viral strains in addition to the strains appeared by spontaneous mutation predisposes to risks the domestic rabbits from farms, which belong to the same species, *Oryctolagus cuniculus*. Vaccination of rabbit broodstock for viral hemorrhagic disease could generate, if not specific immunity, at least a generalized immune response to new contacts with possible RHDV strains.

Conclusions. Feral rabbits in Australia pose a significant threat to biodiversity, affecting 304 endangered plant and animal species. Studies for testing viruses obtained from feral rabbits carried out in 2000's showed that the majority of these viruses were more virulent than the virus used to initiate the epidemic. A new recovery of the feral rabbit population is expected to follow this episode. The production in the laboratory of several viral strains in addition to the strains appeared by spontaneous mutation predisposes to risks the domestic rabbits from farms, which belong to the same species, *Oryctolagus cuniculus*. Vaccination of rabbit broodstock for viral hemorrhagic disease could generate, if not specific immunity, at least a generalized immune response to new contacts with possible RHDV strains.

References

Cox T. E., Ramsey D. S. L., Sawyers E., Campbell S., Matthews J., Elsworth P., 2019 The impact of RHDV-K5 on rabbit populations in Australia: an evaluation of citizen science surveys to monitor rabbit abundance. Scientific Reports 9(1):15229, 11 p.

Fenner F., 2010 Deliberate introduction of the European rabbit, *Oryctolagus cuniculus*, into Australia. Revue Scientifique et Technique 29(1):103-111.

Fenner F., Fantini B., 1999 Biological control of vertebrate pests. The history of myxomatosis: an experiment in evolution. CABI Publishing Series, 339 p.

Oroian I. G., Covrig I., Todoran C. F., Botha M., Blaga B. C., Petrescu-Mag I. V., 2014 Distribution of the European rabbit (*Oryctolagus cuniculus*) in Romania. Rabbit Gen 4(1):60-63.

Petrescu-Mag I. V., 2018 The European rabbit (*Oryctolagus cuniculus*) was introduced for hunting purposes in Republic of Moldova. Rabbit Gen 8(1):1-2.

Ramsey D. S. L., Cox T., Strive T., Forsyth D. M., Stuart I., Hall R., Elsworth P., Campbell S., 2020 Emerging RHDV2 suppresses the impact of endemic and novel strains of RHDV on wild rabbit populations. Journal of Applied Ecology 57(3):630-641.

Ward V. K., Cooke B. D., Strive T., 2010 Rabbit hemorrhagic disease virus and other lagoviruses. In: Caliciviruses: Molecular and cellular virology. Hansman G. S., Xi J. J., Green K. Y. (eds), Caister Academic Press, Norwich, United Kingdom, 248 p.

***Agerpres, 2017 [Feral rabbit populations from Australia, controlled with carrots contaminated by authorities with a lethal virus]. Available at: https://www.agerpres.ro/lifestyle/2017/02/27/populatiile-de-iepuri-daunatori-din-australia-controlate-cu-morcovi-contaminati-de-autoritati-cu-un-virus-letal-12-26-30. Last view: 30 December, 2020. [In Romanian].

Received: 23 October 2020. Accepted: 29 November 2020. Published online: 03 December 2020.
Authors:
Marian Proorocu, Department of Environmental Engineering and Protection, Faculty of Agriculture, University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca, 3-5 Calea Mănăștur St., 400488 Cluj-Napoca, Cluj County, Romania, e-mail: mproorocu@yahoo.com
Dragoș Oroian, Faculty of Agriculture, University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca, 3-5 Calea Mănăștur St., 400488 Cluj-Napoca, Cluj County, Romania, e-mail: dragosoro@gmail.com
Tudor Păpuc, Faculty of Animal Sciences and Biotechnologies, University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca, 3-5 Calea Mănăștur Street, 400372 Cluj-Napoca, Cluj County, Romania, e-mail: ptudor2008@yahoo.com
Antonia Odagiu, Department of Environmental Engineering and Protection, Faculty of Agriculture, University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca, Calea Mănăștur 3-5, 400372 Cluj-Napoca, Romania, e-mail: antonia.odagiu@usamvcluj.ro

How to cite this article:
Proorocu M., Oroian D., Păpuc T., Odagiu A., 2020 Fighting rabbits in Australia by infection with viral strains is just a delay of the invasion. Rabbit Gen 10(1):15-18.