Bacteriophages in companion animals and their *in vitro* effectiveness

Eva Maria Kalbhenn[1,*], Katja-Sophia Klein[1], Wolfgang Beyer[1] and Elisabeth Müller[1]

[1] Department of Microbiology, LABOKLIN GmbH & Co. KG, Steubenstraße 4, 97688 Bad Kissingen, Germany
* Corresponding author

Introduction

The emergence and distribution of multi-drug resistant (MDR) bacteria is one of the most serious problems in human and veterinary medicine. Many of these bacteria have zoonotic potential and can spread between companion animals and humans. This poses a global threat to public health. Bacteriophages exclusively infect and destroy bacteria. They are recognized as the most abundant biological agent on earth and are a suitable alternative or additive for antibiotic therapy, well known since about 100 years in human medicine.

The aim of our study was to determine the *in vitro* efficacy against bacterial isolates of companion animals of different bacteriophage cocktails commercially available for use in humans.

Material and Methods

Multiphage and monophage suspensions as listed in **Fig. 2** (developed by Eliava Institute and produced by Eliava Biopreparations, Tbilisi, Georgia) were tested against various field isolates from companion animals. Samples from ear, external wounds and urine were taken from horses, cats and dogs.

Bacterial isolates derived from routine diagnostics of commercial laboratory (Laboklin GmbH & Co. KG, Bad Kissingen) were used. In our study, we focused on *Pseudomonas* spp., *Staphylococcus* spp., *Proteus mirabilis, Klebsiella* spp. and *Enterococcus* spp..

Species identification was performed by Maldi-ToF MS (Bruker Cooperation, USA) and antibiotic resistance tests were done according to CLSI by Micronaut System with resistance to at least three antimicrobial groups. The susceptibility of the bacterial isolates were tested by a phagogram according to **Fig 1.** Lysis zones were considered as positive (S) and no lysis was considered as negative (R).

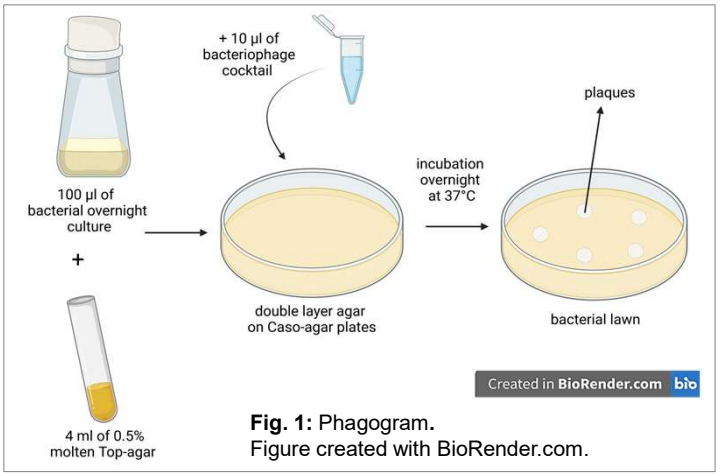

Fig. 1: Phagogram.
Figure created with BioRender.com.

Results and Discussion

A lytic activity of commercially available bacteriophage cocktails for use in humans could be demonstrated against bacterial isolates of companion animals. Depending on the different bacteriophage cocktails, overall a good efficacy e.g. for *P. aeruginosa* of about 80% was observed **(Fig. 2)**. Most infections in companion animals caused by the bacterial isolates of our study would have been treatable with these bacteriophage cocktails. However, *P. mirabilis* shows a low efficacy of about 35%. The efficacy of the bacteriophage cocktails against *S. pseudintermedius* was about 7% and against *S. felis* 30%, adding that no bacteriophages against both strains were indicated in the bacteriophage cocktails. The determination of an efficacy for *K. pneumoniae (*10.5% for Pyo phage), for *K. oxytoca* (30.8% for Pyo phage) and for *K. variiocola* (30.8% for Intesti phage) was unexpected as *Klebsiella* phages are not indicated being part of the bacteriophage cocktails. However, probably due to a broad host range of the present *E. coli* phages also *Klebsiella* spp. strains were lysed. The same phenomenon was observed for *Enterococcus* spp. treated with the bacteriophage suspensions Fersisi, Pyo and Ses, where probably the *Streptococcus* phages were interacting with different *Enterococcus* strains.

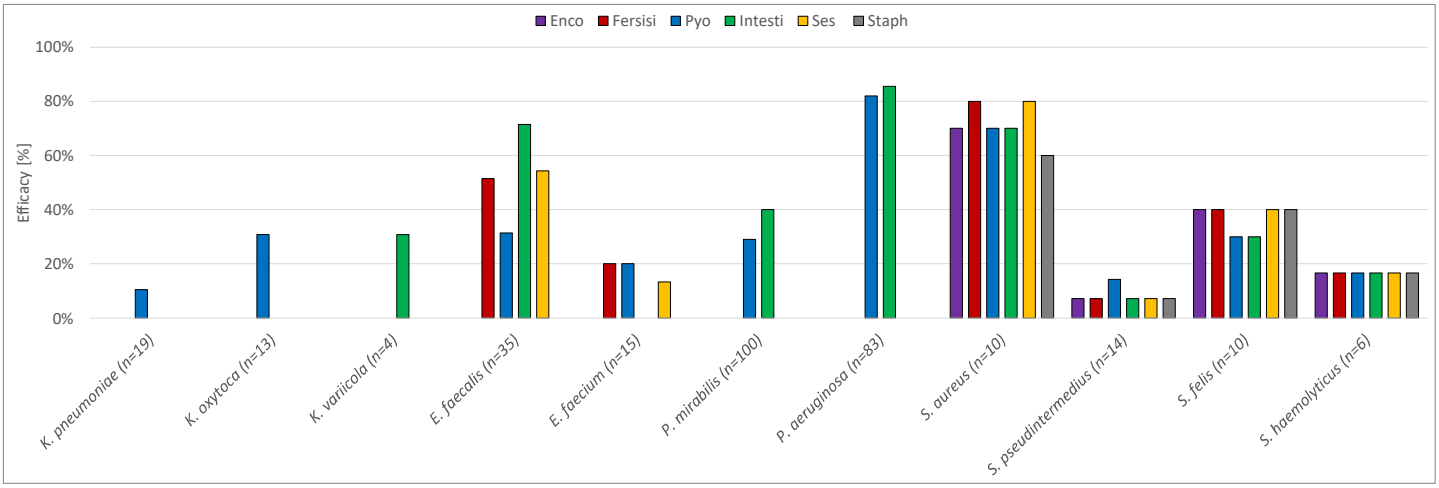

Fig. 2: Efficacy of six commercially available bacteriophage cocktails for use in humans against selected bacterial isolates from companion animals.

Conclusion

This is the first preliminary study investigating the efficacy of commercially available bacteriophage cocktails for human use against different bacterial isolates of companion animals. Bacteriophages are a promising tool for the treatment of multi-resistant bacteria. Further work is needed to develop specific bacteriophage cocktails with high efficacy adapted to animal derived bacterial isolates.

Acknowledgement

Mzia Kutateladze from Eliava Institute of Bacteriophages, Tbilisi, Georgia, and Vakhtang Pavlenishvili from Eliava BioPreparations, Tbilisi, Georgia