

The aim of this project will be the examination of natural plant extracts influence on replication inhibition of an economically important corona- and herpesviruses infecting poultry and swine.

The multiple studies on natural extracts obtained from fruits, herbs, algae, and lichen against human and animal viruses showed their inhibiting potential on their replication in cell cultures and in susceptible animals. Due to the trends in antibiotics reduction, the natural extracts have been also successfully applied to reduce pathogenic bacterial microflora. In case of human and animal viruses, the previous reports indicated on the efficient inhibition replication of herpes simplex virus (HSV-1), hepatitis A virus (HAV), Severe Acute Respiratory Syndrome Coronavirus (SARS-CoV) or in case of poultry - avian infectious bronchitis virus (IBV), avian ortho - (AIV - avian influenza virus) and paramyxoviruses (Newcastle disease virus – NDV) and porcine epidemic diarrhea virus (PEDV). Taking into account the antiviral and biocidal potential of natural plant extracts the technological progress in chemical sciences including supercritical extraction with carbon dioxide facilitated the development of more efficient procedures to obtain the antiviral compounds including phenols, terpenes, flavonoids and flavones from numerous plants including chokeberries (*Aronia melanocarpa*), cloves (*Syzygium aromaticum*), raspberries (*Rubus idaeus*) as well as alpha- and beta-acids (humulones and lupulones) in case of hop (*Humulus lupulus*). The European livestock industry has a value of € 100 billion per year. In terms of poultry and pigs, there are an estimated 1.3 billion pigs and 24 billion poultry. The EU is the second largest pork producer with over 186 million head. In Poland, at the beginning of June 2020, the pig population was higher by 8.9% than the level recorded in the corresponding period of 2019. However, the fluctuations in an annual pig number are caused by the lack of profit in production, mainly because of the occurrence of infectious diseases. The next essential animal production group is poultry. In the first quarter of this year, the production of poultry meat was approx. 7% higher than the year before. The poultry industry in Poland is a rapidly growing sector of the economy, in which over the last 10 years we have increased poultry production twice and export five times.

Although the antiviral effects of many extracts obtained from fruits and herbs have been tested and described, still there are some gaps in knowledge focusing on the sole and synergistic activity of these compounds against viruses. Therefore, the main goal of the studies planned within this proposal is to determine the sole and synergistic effect of 4 natural extracts against Marek's disease virus (MDV), representing an economic problem in poultry, IBV as an equally important coronavirus, occurring in poultry causing inflammation of the bronchi in chickens and porcine epidemic diarrhea virus (PEDV) as the coronavirus representing a serious concern in pig production worldwide. Although PEDV has not been an epizootic problem in Polish pig production yet, it is known that the epizootic diseases do not follow any rule in crossing the geographical borders. The scale of pig and poultry production in Poland presents an urgent need to search for a novel biocidal and antiviral agents effective against economically important pathogens and may also extend the current knowledge about the potential application of natural compounds to prevent further disease spread and economical losses in poultry and swine production. The obtained results will provide important information regarding the antiviral activity of the selected natural extracts and their synergistic activity. A preliminary studies conducted in the past by the Principal Investigator showed effective MDV and PEDV replication inhibition in cell cultures treated with extracts originating from chokeberries, raspberries, and hop. Another advantage of this project and the planned animal trials is to verify the usefulness of the noninvasive sampling strategy of MDV' or IBV' infected chickens by collection of feathers, swabs and dust from the trial rooms as well as in pigs infected with PEDV by collection of oral fluid, nasal, rectal swabs, faeces and dust. The comprehensive studies on the antiviral activity of natural extracts performed as in *vitro* and *in vivo* studies will provide reliable information of the effective antiviral activity of the compounds present in fruits and herbs. The direct profit from the obtained results will broaden the current knowledge in terms of modern pharmacology, animal welfare, and virology as well as an alternative sampling strategy to avoid the suffering of animals used as a model in animal trials.