SIRS+P model of cow mastitis

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Abstract. Mastitis is a disease in cows that reduces their milk production and affects the milk market. This disease is transmitted from bacteria present in the environment where cows live or can be transmitted from cow to cow. Due to the negative economic significance of the disease, a mathematical model of differential equations called SIRS+P has been developed. The model is dynamic, and the population of cows on the farm is divided into three groups: susceptible, infected, and recovered. Since the disease can also arise from bacteria in the environment where cows live, the environment's influence is considered. On the other hand, cows do not develop immunity to this disease, so it can recur multiple times, meaning that this aspect must be considered in constructing the model. The stability of the model in the bounded region has been proven. The basic reproduction number has been determined. Both equilibria for containment or occurrence of an epidemic based on the system parameters have been found. The local and global stability of the equilibrium has been examined. Finally, this system has been applied to a real case on a Macedonian cow farm.

Keywords. Mathematical model, cow mastitis, basic reproduction number.

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