The aim of the project research is to provide a new scientific contribution to the methodology of influence of shapes and arrangements of holes in flat, perforated plates, used as sieves on the form and extent of damage in biological material, during automated sifting processes.

The reason for considering the topic is, on the one hand, the absence of patterns of change in the degree of damage of biological materials depending on the constructive and kinematic parameters of perforated sieves, and on the other hand, the high technological efficiency of sifting through the holes of a complex geometric shape.

An additional problem in optimizing the parameters of such processes is their multicriteria, namely: technological productivity and quality of separation of biologic material components through the sieves holes, the degree of material damage, the reliability of perforated sieves, the energy- and metal consumption of the structure.

Planned research included in the project, will be used analytical derivation of data reduction schemes for the considered stress concentration test configurations, appropriate finite element modeling of a perforated surface with holes of complex geometric shape, and experimental verification of analytical and numerical results in bench tests.

The task of the study will be to identify the impact of the hole design on the general mechanical and strength properties of perforated surfaces, as well as on damage to biological material. The use of the obtained methodology will allow to study and apply an exclusive simulation modeling (FE-modeling), which is much cheaper than time consuming experimental tests.

Bench tests will be conducted on two sets of perforated surfaces with basic holes and with highly productive geometrical activators: epicycloid-shaped holes and volumetric elements. To determine the durability, vibration and typical loads will be applied to the samples.

A comprehensive numerical analysis of stress concentrators on sieves with different variants of holes in the software environment Finite Element Analysis (FEA) will be performed (Fig. 1). The ABAQUS program installed on two workstations (computers with high computing power) will be used for this purpose.

The degree of seeds damage in the form of macro- and microdamages is planned to be investigated using ultrasonic testing and fractographic analysis will be performed with microscopic techniques. That will allow to receive important data on internal damages (Fig. 2).

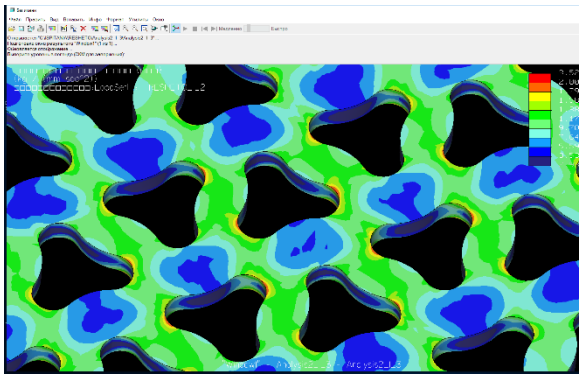

Figure 1. An example of the obtained distribution of stress concentrators in a perforated sieve, which determines its reliability

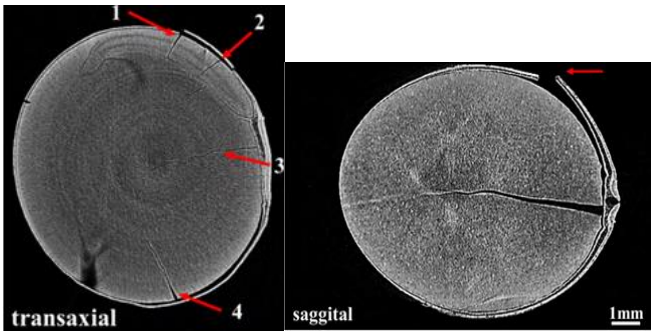

Figure 2. Example of obtaining the structure of internal damages of biologic material

The result of the research will be the dependence of the degree of damage to biological materials, taking into account their structural and kinematic parameters of vibrating sieves, their reliability and technological productivity