**Abstract**

This paper is dedicated to characterize yeast microbiota present during the white cabbage fermentation (*Brassica oleracea* var. *capitata* f. *alba*). The planned research was carried out in four stages. The main aim was to detect and characterize yeasts present during the sauerkraut fermentation. The research included establishment of the following:

- Quantitative and qualitative composition of yeasts during the spontaneous fermentation of various white cabbage cultivars,
- Influence of vessels used for fermentation on the yeast microbiota composition and qualitative features of the sauerkraut,
- Physiological characterization of the obtained yeast isolates,
- Influence of the mentioned yeasts on the course of the fermentation and selected elements of the silage chemical composition.

During the analyses classical microbiological tests were used (spread plate method, assimilation and fermentation tests) with the usage of molecular biology methods (PCR-RAPD, sequencing), as well as chemical methods, i.a., spectrophotometry (establishment of FAN, sugars and lactic acid) and chromatography (HPLC, SPME-GS-MS).

Based on the obtained results it was stated that cabbage cultivar had influence on the quantity of present lactic acid bacteria and yeasts during the fermentation, as well as on the pH level and lactic acid contents. Beneficial characteristics by the means of the analyzed parameters were detected in Galaxy and Kilaton cultivars. During the sauerkraut fermentation four yeast species were present, i.e., *Pichia fermentans*, *Rhodotorula mucilaginosa*, *Wickerhamomyces anomalus* and *Debaryomyces hansenii*. The last of the mentioned species was represented by three different strains.

Significant differences in the yeast microbiota composition and analyzed chemical parameters were detected depending on the vessel used for the fermentation (glass jar vs. stoneware vessel). Using glass jars for fermentation led to decrease of the present yeasts number, it also influenced the qualitative composition of microorganisms belonging to that griup. Only in the case of the glass jars cells of the yeast species *Clavispora lusitaniae* were detected, whereas in the case of stoneware vessels – *Wickerhamomyces anomalus*.

Taking expected pH value and the lactic acid concentration into consideration sauerkraut fermentation in glass jars could have been ended four days earlier than in the case of stoneware vessels. The product received after the process carried out in glass jars was





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characterized by the higher lactic acid and mannitol contents, as well as the lower acetic acid content.

The analysis of the izolates obtained during the sauerkraut fermentation showed that most of the obtained yeast species preferred for their growth the temperature above 30 C and could easily grow with the presence of up to 10% NaCl in the environment. Apart from *Rhodotorula* species representatives, yeast strains present during the fermentation are facultatively anaerobic.

On the basis of various carbon sources metabolism, it was possible to detect glucosophilic cultures (*Debaryomyces hansenii*, *Wickerhamomyces anomalus*, *Pichia fermentans*, *Clavispora lusitaniae*) and fructosophilic ones (*Debaryomyces hansenii*, *Wickerhamomyces anomalus*, *Rhodotorula mucilaginosa*). The mentioned microorganisms were also able to grow on glycerol, however, they used saccharose and mannitol less efficiently for the growth.

Significant differences were detected in the volatile compounds produces by the isolates profile, which was also influenced by the sugars present in the growth medium. 35 compounds were detected with predominant alcohols and esters. Strains responsible for the biggest amounts of the mentioned compounds were *D. hansenii* 1, *P. fermentans* 32 and *C. lusitaniae* 34.

Each yeast strain influence on the sauerkraut fermentation process tests showed the tested microorganisms are capable of utilizing of up to 2/3 of the produced lactic acid and even doubling the level of the present acetic acid. The mentioned strains caused a significant volatile compounds concentration increase, both typically microbiological-derived ones (esters, i.e., ethyl acetate, ethyl octanoate, alcohols – 2-methylpropanol, 3-methylbutanol) and compounds created during the plant components decomposition (cyanates, nitriles, sulphides, terpens). The biggest amounts of the present aromatic substances were detected in the case of the product obtained with the usage of *W. anomalus* 6 and *D. hansenii* 1 yeast strain.