3rd International Conference
ðResearch & Innovation in Engineering ð
COMAT 2014
16-17 October 2014, Braşov, Romania

RESEARCH REGARDING THE CAUSES THAT PRODUCE THE BERRIES ALTERATION

D. D. Păunescu[1], Gh. Brătucu[1]
[1]Transilvania University of Braşov, Braşov, ROMANIA, paunescu.dan@unitbv.ro

Abstract: *There are a number of microorganisms on the fruit surface, which can vary in very large amount and grow while they find proper conditions to develop. Microorganisms originate from the environment, most from air, being brought by dust, insects or animals, but also originate from the soil or the rainwater or irrigation water. The presence of a pathogenic microflora in the mass of berries involves many negative aspects which generate losses for producers but also for their processors.*
Keywords: *alteration, berries, microorganisms*

1. INTRODUCTION

In the "*Strategy for developing the agri-food sector on the medium and long horizon 2020-2030*" developed by the *Ministry of Agriculture and Rural Development* in 2014 it is said that "Although agriculture has always focused on food security and has been a positive engine of economical growth, in the last decades increasing concern of the society for the environment has affected the agricultural policies worldwide. Starting with the Earth Summit of the United Nations in 1992, the sustainable development has received worldwide recognition, and consumers began to concern themselves with increasingly environmental sustainability of agriculture. Willingness to know where food comes from, how it was produced and if the agricultural practices were environmentally friendly are just some of today's consumer demands [1].
The quality and food safety have become a right of consumers with direct effects on the quality of life, and the issue focused on this aspect is in the spotlight of the established bodies in order to protect the interests of consumers [2].
Considering these issues, the need and requirement of berries conditioning berries before processing is a compulsory requirement to ensure the optimal conditions for storage, commercialization, consumption and processing of this category of products.

2. ANALYSIS OF THE MAIN PATHOGENS FACTORS THAT CAUSES THE ALTERATION OF BERRIS

Berries can be considered finished goods when they are eaten fresh and raw material for industry, when they are subjected to processing in a wide range of products.
Fresh fruit is the ideal form of consumption of this category of food, as presented intact the natural qualities, such as flavor, taste, color, high content of essential vitamins vital for the body etc. However, high water content, tissue fragility and heavy breathing which characterize these species are factors that favor their qualitative impairment.
Because after harvesting the berries lose their natural immunity been subjected to the action of external factors (temperature, humidity, light, epiphytic flora etc.), the preservation of these species until reach consumers or the processing units can be done only on a short period of time.
The changes caused by biological agents are mainly due to microorganisms that found a medium conducive to their development in berries and comprise the following processes: fermentation, putrefaction and alteration produced by and toxigenic and pathogenic germs [3].

Microorganisms are the main agents of the berries alteration, being represented by bacteria and fungi (yeasts and molds). Bacteria are microorganisms with a high power of alteration, with increased proliferation rate, some of them being highly toxigenic.
Yeasts are unicellular microscopic fungi with a reduced share in the total microflora of berries. They break down various components of the raw materials rich in carbohydrates and water, in an acid medium, leading to fermentation [2].
Among the molds, gray mold produced by the *Botrytis cinerea* fungus has the highest contribution to the depreciation of berries, being one of the most widespread diseases thereof (Figure 1).

Figure 1: Blackberry fruit - infections caused by *Botrytis cinerea (photo Jason Smith)*

Botrytis cinerea is a necrotrophic fungus that affects many plant species, although its most notable hosts may be wine grapes. In viticulture, it is commonly known as botrytis bunch rot; in *horticulture*, it is usually called *grey mould* or *gray mold*.
Botrytis cinerea affects many other plants. It is economically important on soft fruits such as many berries. Unlike wine grapes, the affected strawberries are not edible and are discarded. To minimize infection in strawberry fields, good ventilation around the berries is important to prevent moisture being trapped among leaves and berries. A number of bacteria have been proven to act as natural antagonists to *Botrytis cinerea* in controlled studies [4].
Gray mold (*Botrytis cinerea*) causes raspberry fruit to rot and become moldy while still on the canes (Figure 2). The gray mold fungus can also infect blossoms, stems and senescent leaves of raspberry plants. Gray mold is most common in fall-bearing raspberries, in dense patches of raspberries, and in patches with little air movement due to surrounding trees and buildings. In ripe fruit, gray mold may not appear until after picking, resulting in reduced shelf life. The disease can rapidly spread among fruit in a container.

Figure 2: Raspberry fruit infected with *Botrytis cinerea*
(Michelle Grabowski, UMN Extension)

Anthracnose or ripe rot is a common pre-and post-harvest fruit rot of blueberry. It is caused primarily by the fungus *Colletotrichum acutatum*.
The fruit is the most susceptible to anthracnose. Berries do not develop symptoms until they are mature or ripe. The initial symptoms usually appear near the calyx (blossom) - end on ripe fruit as dark, sunken areas and the infected areas may shrivel with time (Figure 3). Within a few days, bright salmon-orange colored, wet spore masses can be seen on the shrunken areas (Figure 4) [5].

Figure 3: Fruit infected with anthracnose

Figure 4: Masses of salmon-orange colored

These sticky spore masses often spread to other berries by rain, irrigation, splashing water and contact during harvest, resulting in substantial pre - and post - harvest losses.

Mature red fruit are most commonly infected with gray mold, although blossom blight occasionally occurs in cool, wet weather. Velvety gray spores completely cover infected areas of the fruit. The top of the fruit is often infected first, near where the fruit attaches to the stem, but this very quickly spreads to the entire fruit. Infected fruit remain attached to the plant and dry up into a shriveled black mummy. The shriveled fruit may produce new spores in wet weather [6].
Late leaf rust is caused by the fungus *Pucciniastrum americanum*, and only infects red and purple raspberries (Figure 5). In rare cases, late leaf rust can cause premature defoliation of both summer-bearing and fall-bearing raspberries, reducing the yield and quality of the fruit while making the canes more susceptible to winter injury.

Figure 5: Raspberry fruit infected with *Pucciniastrum americanum*
(Michelle Grabowski, UMN Extension)

Late leaf rust is most commonly seen on the fruit of fall-bearing raspberries. Typically, one to three drupelets will be covered with bright orange powdery spores in September. The disease can also cause spots of bright orange powdery spores to form on the underside of the mature leaves [6].
In the berries' microflora may appear by accident pathogens and facultative microorganisms such as Escherichia, Salmonella, Shigella, Yersinia enterocolitica, bacteria that cause disease or foodborne disease. These germs can cause fruits alteration in all processes of raw materials' processing [7].
Escherichia coli, commonly abbreviated E. coli (Figure 6) is a Gram-negative, facultative anaerobic, rod-shaped bacterium of the genus Escherichia that is commonly found in the lower intestine of warm-blooded organisms (endotherms). Most E. coli strains are harmless, but some serotypes can cause serious food poisoning in their hosts, and are occasionally responsible for product recalls due to food contamination. The harmless strains are part of the normal flora of the gut, and can benefit their hosts by producing vitamin K2, and preventing colonization of the intestine with pathogenic bacteria [8].

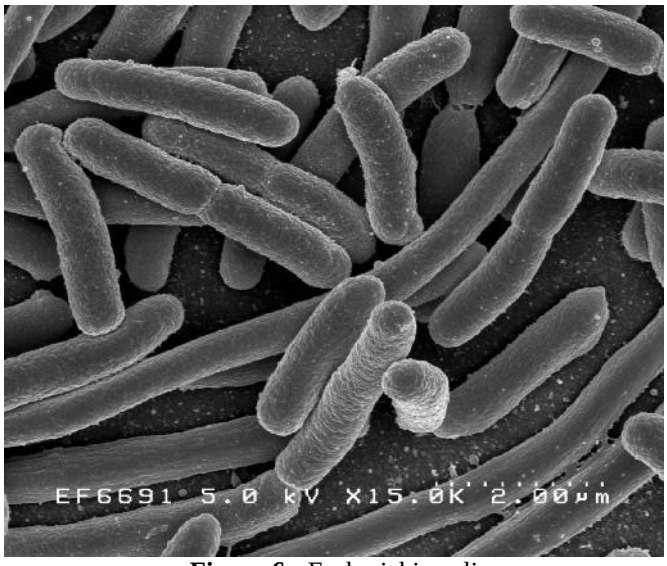

Figure 6: Escherichia coli

Most people recover within seven to 10 days, but a few people will develop Hemolytic Uremic Syndrome (HUS), an unusual type of kidney failure and blood disorder, which can be fatal.
The berries' contamination may occur through their manipulation by workers with unwashed hands.
Salmonella (Figure 7) is a genus of rod-shaped, Gram-negative bacteria. There are only two species of *Salmonella*, *Salmonella bongori* and *Salmonella enterica*, of which there are around six subspecies and innumerable serovars. *Salmonellae* are found worldwide in both cold-blooded and warm-blooded animals, and in the environment. They cause illnesses such as typhoid fever, paratyphoid fever, and food poisoning [8].

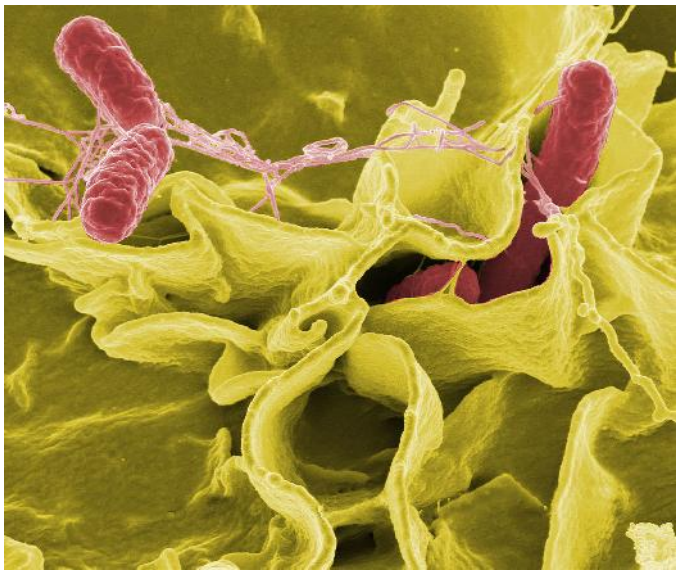

Figure 7: Salmonella

Salmonella species are facultative intracellular pathogens. Many infections are due to ingestion of contaminated food. *Shigella* (Figure 8) is a genus of Gram-negative, facultative anaerobic, nonspore-forming, nonmotile, rod-shaped bacteria closely related to Salmonella. The genus is named after Kiyoshi Shiga, who first discovered it in 1897.

Figure 8: Shigella [9]

The causative agent of human shigellosis, Shigella causes disease in primates, but not in other mammals. It is only naturally found in humans and apes. During infection, it typically causes dysentery. Shigella is one of the leading bacterial causes of diarrhea worldwide. Insufficient data exist, but conservative estimates suggest Shigella causes about 90 million cases of severe dysentery, with at least 100,000 of these resulting in death, each year, mostly among children in the developing world.
Yersinia enterocolitica (Figure 9) is a Gram-negative coccobacillus-shaped bacterium, belonging to the family Enterobacteriaceae. Y. enterocolitica infection causes the disease yersiniosis, which is a zoonotic disease occurring in humans, as well as a wide array of animals such as cattle, deer, pigs, and birds [4].

Figure 9: Yersinia enterocolitica [10]

Yersinia enterocolitica is widespread in nature, occurring in reservoirs ranging from the intestinal tracts of numerous mammals, avian species, cold-blooded species, and even from terrestrial and aquatic niches. Human pathogenic strains are usually confined to the intestinal tract and lead to enteritis/diarrhea.

3. CONCLUSION

- There are a number of microorganisms on the fruit surface, which can vary in very large amount and grow while they find proper conditions to develop;
- Microorganisms originate from the environment, most from air, being brought by dust, insects or animals, but also originate from the soil or the rainwater or irrigation water;
- The changes caused by biological agents are mainly due to microorganisms that found a conducive medium to their development in berries and comprise the following processes: fermentation, putrefaction and alteration produced by and toxigenic and pathogenic germs;
- The berries' contamination may occur through their manipulation by workers with unwashed hands
- The quality and food safety have become a right of consumers with direct effects on the quality of life, and the issue focused on this aspect is in the spotlight of the established bodies in order to protect the interests of consumers.

REFERENCES

[1] *** www.madr.ro
[2] C.C. Florea, Contributions to the improvement of technology and equipment used for the conditioning of herbs and berries before processing, PhD thesis, Transilvania University of Brasov, BRASOV, 2013
[3] C.D. Mişca: Microbiology of agrifood, Publisher Solness, Timisoara, 2001
[4] *** www.encyclo.co.uk
[5] *** http://www.agf.gov.bc.ca
[6] *** http://www.extension.umn.edu
[7] *** Zara, M.: Innocuity of food products, Publisher EuroPlus, Galaţi, 2006.
[8] *** http://en.wikipedia.org
[9] *** http://www.cdc.gov
[10] *** http://www.sekisuidiagnostics.com

ACKNOWLEDGEMENT: This paper is supported by the Sectoral Operational Programme Human Resources Development (SOP HRD), financed from the European Social Fund and by the Romanian Government under the project number POSDRU/159/1.5/S/134378.