Journal of
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A new framework of academic and publicist development

As a consequence of the continuous evolution and of the almost a decade and a half experience concerning the going on of **BIOATLAS International Conference** and the publication of the **Journal of EcoAgriTourism**, there came the moment to pass to another level of manifestation. We are referring to an institutional and managerial collaboration with the *Association the Romanian Society for the Information technology in Agriculture, Food, Environment and Tourism (Societatea Română pentru Tehnologia Informaţiei în Agricultură, Alimentaţie, Mediu şi Turism*) regarding the (finalized) procedure of brand registration (*brand type:* verbal and *brand sort:* individual), as it follows: the ***BIOATLAS brand - International Conference*** is registered at the 41st Class, and the ***Journal of EcoAgriTourism Brand*** is registered at the 16th Class.

We are mentioning the historical background of the two brands. Thus, the **„BIOATLAS -International Conference"** is continuing the „BIOTALAS" Conference / Environment Protection by Biological and Biotechnical Methods and Means and the Conference for Eco-Health Generating, between 2003-2006, and since 2008 until 2018 it became the BIOATLAS International Conference, 6 editions respectively. As for the review, we must remind that the publication manner is based on peer-review, both of the submitted papers during conferences, and the ones directly sent to the review. The **„Journal of EcoAgriTourism"** - JEAT (ISSN: 1844-8577) publication is continuing the „EcoAgroTourism Review"/ Revista de EcoAgroTurism (ISSN1841-642X), with issues in Romanian even since 2005.

At present there is aimed to improve the image at international level, for both registered brands, by various collaborations, especially at institutional level, including for example that BIOATLAS may take place in different towns or countries. The objective is to improve the quality of the published scientific papers, so that there may be solved more and more aspects of agritourism, ecotourism, gastrotourism and tourism industry in its whole. There is intended that the level of the readers may be increased in order to increase the impact factor, both for the review and for the international conference.

Director of the publication,
Full Prof. Romulus GRUIA,
PhD, PhD supervisor

SUMMARY

COMPARATIVE SENSORY AND PHYSICO-CHEMICAL ANALYSIS OF THE TWO BUTTER VARIETIES

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Abstract: *Butter is a highly consumed worldwide because of sensory features in pleasant and potential in maintaining and improving health. It is one of the most important food due to its nutritional and energetic. Butter and lovage is based formulation of the classic butter. The addition of lovage has important health benefits to the consumer, having a role in treating certain dermatitis, disorders and relax the nervous system. The purpose of the study is to obtain a butter with added lovage containing biactival compounds and comparative analysis of this product with classic butter. The research was conducted over a three-month period to determine the main characteristics.*

Keywords: *butter, health, lovage, biactival compounds*

1. Introduction

Butter is an important dairy product in human nutrition due to it is nutritional and energetic properties [1]. The energy value of the butter is about 7600 kcal / kg. This product has been known since antiquity, from the ancient Greeks who lived in northern Greece and used butter for food. The word butter, was translated by the Greeks, by the word burnt - referring to the cheese of cows [2].

The need for daily consumption of butter has been proven by doctors as butter components are involved in the synthesis of substances that regulate the immune system and normal functioning of the nervous system. For this reason there is research showing that use natural ingredients with health benefits butter is one way to increase improved quality butter from the point of sensory, and physical-chemical and microbiological.

In a study of carrot powder enriched with butter it has been shown to improve the organoleptic and consistency properties by increasing the toughness and heat resistance.[3] Another study, namely adding cinnamon butter containing bioactive ingredients such as antioxidants, polyphenols and flavonoids extended shelf life of butter due to its antioxidant activity.[4] Obtaining butter with added bioactive components such as

ADOS of Satureja Cilic aimed to determine antioxidant activity of oxidation, chemical properties, stability butter and aromatic properties of plant data [5]. In this study was used Lovage (Levisticum officinale).

Lovage (Levisticum officinale) - is a herb, medicinal, therapeutic action with a strong respiratory, endocrine, and immune system, the root of this plant is one Mediterranean and is known since ancient times. (Green living life without year).

Lovage is a plant that is quite strong and is found in damp places. It has a thick root, which is branched fleshy. The stem of this plant is its hollow inside, is round, slightly knurled and can reach lengths of 1-2 meters. (Green tea with no year). This plant is resistant to cold, and its origin is in southern Europe. It grows wild in the Apennines, but rather cultivated in Romania, France, Germany, Switzerland and South. [6]

The chemical composition of lovage:

- The root of this plant starch present in its composition, sugar, sucrose, water and resin;
- Fresh root contains between 0.3 - 0,5% oil and dried root contains between 0.6 - 1% of oil;
- This herb also contains caffeic acid, ferulic acid, benzoic acid, angelic acid, isovaleric acid;

- All parts of lovage contain volatile oil, tannin, fat and minerals.[6]
- Acts beneficially on the cardiovascular system
- Tones the body, clean the gall bladder and relaxes the nervous system
- It is indicated for the acute and chronic bronchitis, cough and asthma, respiratory diseases has expectorant effect in
- It has antifungal properties and antidepressants
- It has a diuretic action

The tea is prepared from the seeds of lovage, stomach pain reliever.

2. Materials and methods

The research has been performed in the milk technology laboratory, and the study used sweet cream from a private dairy factory, which was analyzed for acidity. It was heated to a temperature of 20°C and seeded with a Starter culture of mesophilic lactic acid bacteria formed only from Streptococci, being submit operation biochemical maturation in the oven (at 20°C) until the acidity of 55°T. The biochemically matured sour cream was cooled to 5°C and left to physical maturation for 12 hours. With the help a mixer, has been submit to a beating operation and resulted the butter. The butter was divided into two parts, and one of the two was mixed with the lovage. The lovage proportion added in butter is 1,5 grams per 200 grams of butter, representing the optimal proportion.

Benefits of lovage [7]:

In making this study, the methods of analysis used are[8]:
1. Sensory analysis was performed to assess the sensory characteristics by the scoring method.
2. Determination of acidity, by titration with 0,1N sodium hydroxide solution in the presence of phenolphthalein as an indicator, the result being expressed in degrees of acidity; according to STAS 6353-75.
3. Determination of the acidity index is the amount of potassium or sodium hydroxide required to neutralize free fatty acids contained in one gram of fat, expressed in milligrams of reagent/gram of fat, according to STAS 9952/2-82.

Determination of freshness by the Kreiss reaction, is achieved by treating the butter sample in acid medium with floroglucin. The appearance of a red color indicates the presence of the epihydrin aldehyde resulting from the first stage of butter degradation according to STAS 6350-74.

3. Results and discussions

1. The sensory analysis of butter and butter with lovage was made with the help of five ordinary people aged between 23 and 68 years old. For this, the scoring method was used, according to Stas 6345-74.

The sensory analysis for the two butter varieties is shown in the following figures:
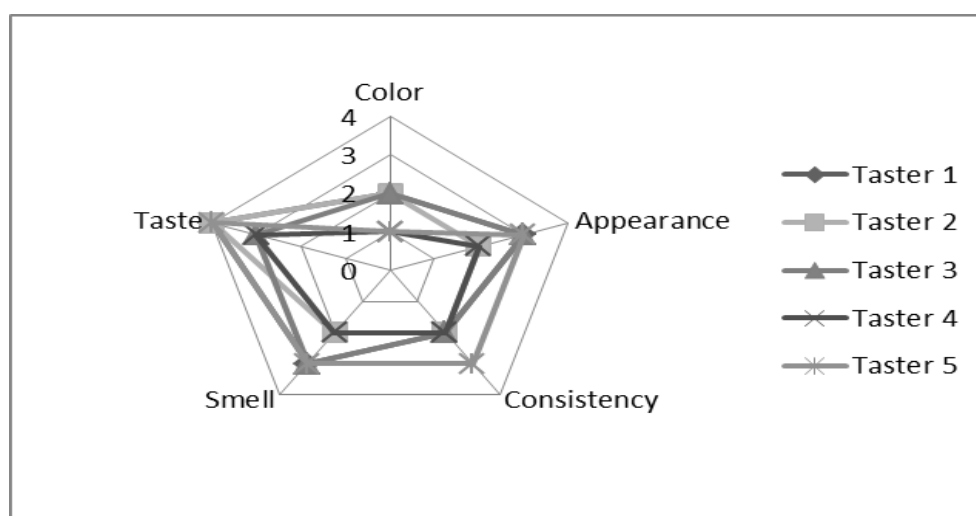
Fig. 1. *The sensory analysis for classic butter*
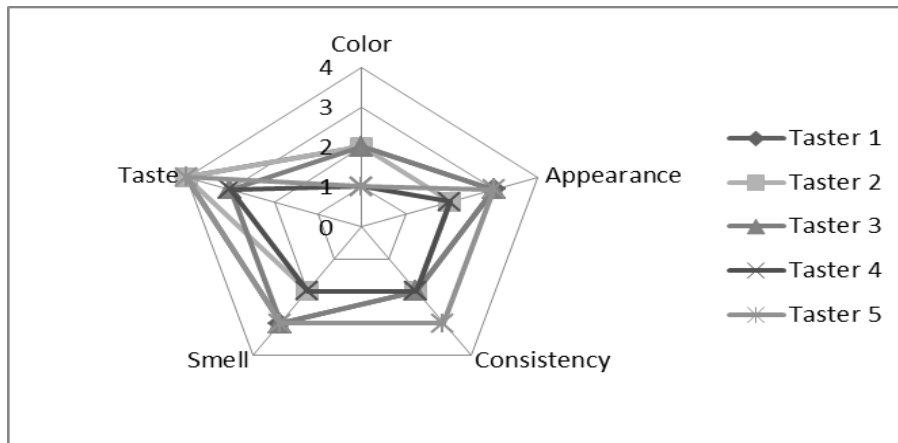
Fig. 2. *The sensory analysis for butter with lovage*

As a summary of the results, it is noticed that the butter with lovage obtained the highest results for all the sensory characteristics that were analyzed, which indicates the this assortment of butter is appreciated by consumers.

2. Determination of acidity for the two types of butter is shown in figure 3.
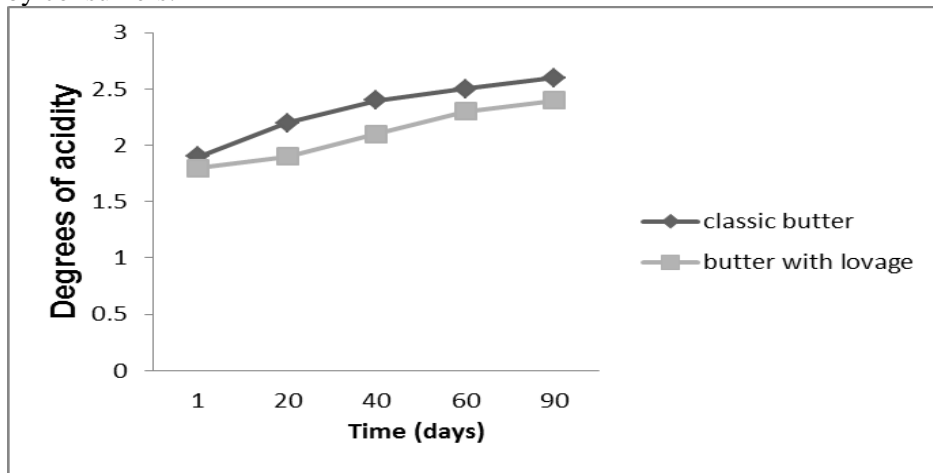
Fig. 3. *Evolution of acidity for classic butter and for butter with lovage*

From the results presented, it is noticeable that the butter with lovage has a slightly lower acidity than the classic butter, but for both assortments there is a slight increase for this chemical characteristic over the analyzed period. We believe that this difference in acidity of butter with lovage is also due to the chemical composition of the lovage.

3.Determination of the acidity index for the classic butter and the butter with lovage is shown in fig.4.
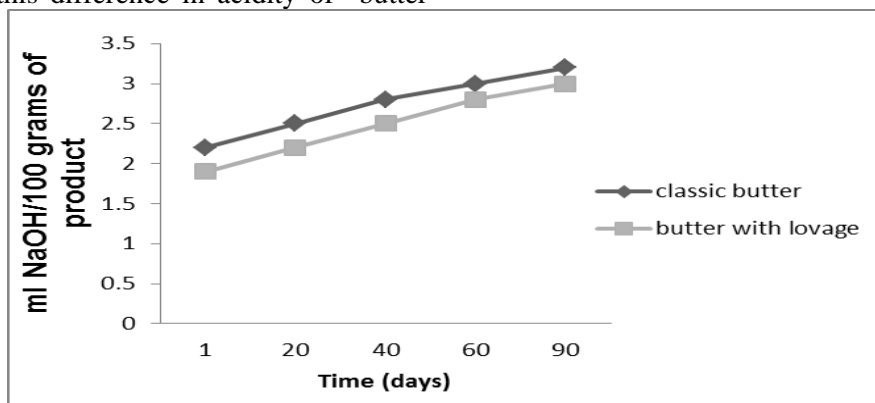
Fig. 4. *Evolution of the acidity index for classic butter and for butter with lovage*

From the graph we can see that the acidity index has a slow increase for both butter assortments analyzed during the chosen period, and the classic butter has higher values than the butter with lovage. The results obtained are in line with the quality standards in force.

4. Determination of freshness by Kreiss reaction

The results obtained are presented in the following table:

Table 1. *Degree of freshness – Kreiss reaction*

| Nr.crt.	The assortment of butter	Coloration				
		1	20	40	60	90
1.	Classic butter	white-yellow	white-yellow	white-yellow	white-yellow	white-yellow
2.	Butter with lovage	white-yellow	white-yellow	white-yellow	white-yellow	white-yellow

The table shows that during the analyzed period, the degree of freshness was appreciated according to the coloration obtained, respectively, the coloration was yellowish white, which means that the butter is fresh, freshness that depends greatly on the storage conditions, which in our case were 2,5°C.

Conclusions

Following analyzes, the following conclusions were drawn:
• The butter with lovage has been appreciated by tasters for his sensory qualities
• The acidity and acidity index showed small increases over the analyzed period, but the classic butter had higher values than butter with lemon
• The composition of butter with lemon, we assume that it has undergone small positive changes by the addition of lovage which comes with different substances and which improves the composition of the obtained product
• Both types of butter during the analyzed period were yellowish white, this means that butter is fresh.

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CHARACTERISTICS OF WOOD BIOMASS

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Abstract: *The paper show the importance of wood, which has a high caloric capacity and can be supplied at can be supplied at a much lower price to each consumer, compared to fossil fuel. The importance of analyzing the caloric power of the wood and generally the entire whole called biomass could change the vision of cutting tree and exploiting them. Each species has it own energy capability that make any particle of the wood cut to be harnessed. Biomass is the most widespread resource, including wood biomass and residues from the wood process industry. The capitalization of wood and wood products can allow for greater energy potential for many houses and blocks by using green energy.*

Keywords: *biomass, calorimeter bomb, energy density, wood*

1. Introduction

At present , much of the energy need by mankind is produced from fossil fuel. Fuel in the world is in three forms: fossil, nuclear, renewable. Fossil fuel according to research carried out by the European Union seriously damage the environment.

The Governamental Committee of Europe in thr year 1992 has tried to implement some renewable energy strategies. In the year 2002, the Myth of Johannesburg adopted the plan to implement energy consumption from alternatives resources. The plan consists of 10 year strategies and programmes, which are directed by UNEP (United Nations Environment Programme). At legislative level, implemetation of the use of alternative resources to obtain energy has evolved a great deal.

Researches from all over the country have implemented a lot of projects to reduce carbon dioxide emissions. A major objective was to intensify the use of wood as a raw material for heating the housing. According to the studies of the International Energy Agency (IEA) over the next few years there will be an essential increase in the amount of fuel exported from the Middle East, a fact caused by the decline of production in the North Sea and other OPEC area (The Organisation of oil-exporting countries).

The greatest danger the use of fossil fuel consists of harmful emissions that area eliminated in the atmosphere. The extraction processing and use of fossil fuel emit in the atmosphere approximately 98% of the total amount of carbon dioxide, which negativ influences both the evaluation of the living micro-organisms and of human life.

The states with sea and ocean exit can use tidal energy, and nordic states can use biomass energy, hydro. All developed countries orient their gase towards alternative energy sources.

In the world then are 4 great forces of nature (sun, wind, water, biomass) that have a potential to provide energy without influencing or causing major environmental damage (Fig.1).

Currently biomass is a renewable energy, existing in large quantities on the Earth globe.
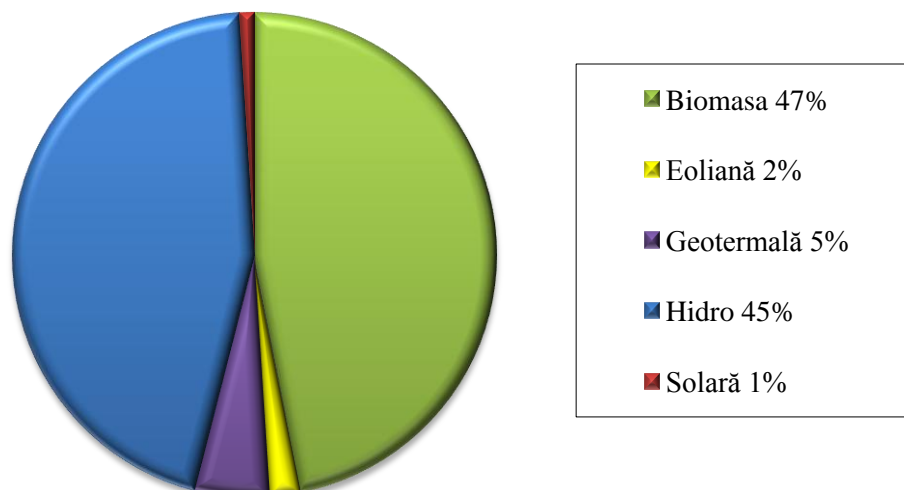
Fig. 1. *The energetic potential of renewable resources of 2004 year of level European Union*

After the latest estimation, biomass can produce energy up to 47% compared to other renewable energy sources at EU level.

The production and consumption of combustible materials ensure the quality of the human life need.

In the countries of the European Union it is desirable that by the year 2030 to reach the threshold of consumption of 20% of the energy produced from alternative energy sources, which is very possible and the biomass ensure the major energy requirements.

The reserves of wood biomass differ throughout the European Union and worldwide. The forest range from 27.6 million hectares in Sweden to 117 hectares in Cyprus.

At global level, the forestry fund occupies 4 million hectares, the largest quantity being distributed on the teritory of the Russian Federation, 809 million hectares. Of the 28 states of the European Union, Romania was 8 th after its forestry fund. Globaly Romania owns 0.15% of the entire forest land area of the world.

2. Materials and methods

The installation used to determine the calorific value of wood biomass was the XRY-1C explosive type burner produced by Shanghai Changji Geological Institute in China (fig.2).

The method of determining the calorific value of wood material refers firstly to the preparation of the raw material, the to the actual determination and ultimately to the final result.
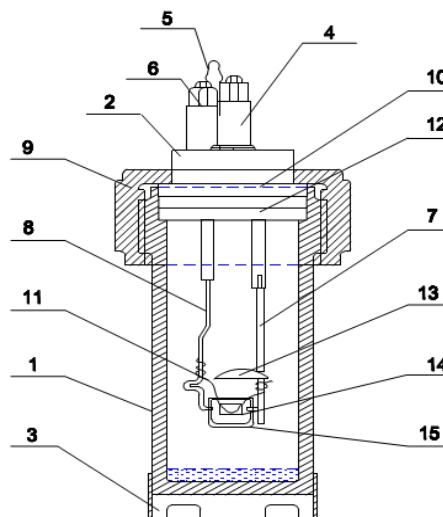
Fig. 2. *Calorimeter bomb*

The test sample 1 binds to the cotton yarn 2 and put in the crucible of the bomb 3.

Connect the spiral nickel wire 4 to the sample and the cotton yarn, the place the protective cap 5 correctly.

The crucible is connected to the calorimetric bomb cap 6 by 2 electrodes 7 and 8, which continues with the electrical coupling bomb of the calorimetric bomb 9 and 10.

By bombing cap, the bomb 11 is coupled throught the stator 12 to the oxygen cylinder, introducing 3 atmospheres.

In figure 3 is presented working diagram.
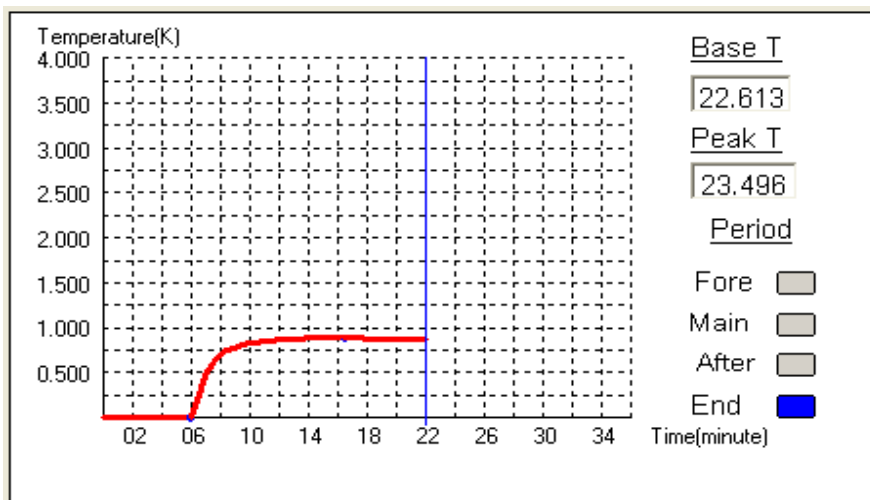
Fig. 3. *Working diagram*

The test contains three distinct periods (fig.4).
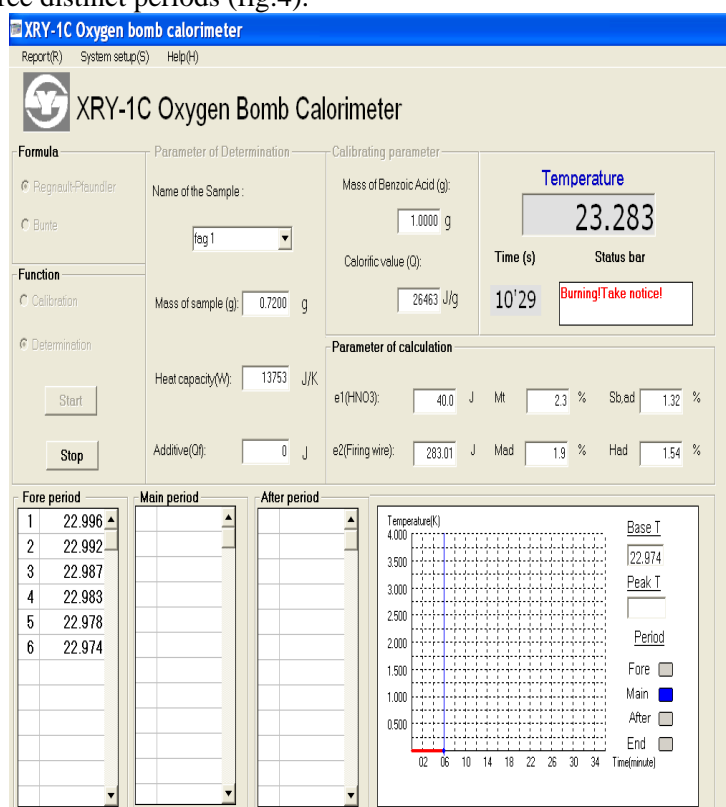
Fig. 4. *Three distinct period at calorimeter bomb*

The initial period aim to determine the the temperature variations of the water in the calorimetric vessel due to the heat exchange with the outside before the combustion.

The main period start with the ignition of the sample and consequently increases the temperature of the water in the calorimetric vessel. The final period aim to determine the average temperature variation of the water in the calorimetric vessel due to heat exchange with the outside.

For *fagus silvatica*, m1 = 0,6900 g, U = 0%, gross calorific value is 19647 kJ/kg, net calorific value is 19051 kJ/kg, energy density = 16,466 kJ/cm3 ,m2 = 1,1420g, U = 10 %, gross calorific value is 16878 kJ/kg, net calorific value is 16639 kJ/kg, energy density = 17,274 kJ/cm3, m3 = 0,8750 g, U = 20%, gross calorific value is 14497 kJ/kg, net calorific value is 13980 kJ/kg, energy density = 16,310 kJ/cm3, m4 = 1,4260 g U=50%, gross calorific value is 6994 kJ/kg, energy density = 8,411 kJ/cm3.

In fig.5 is presented variation of energetic density for *fagus silvatica.*
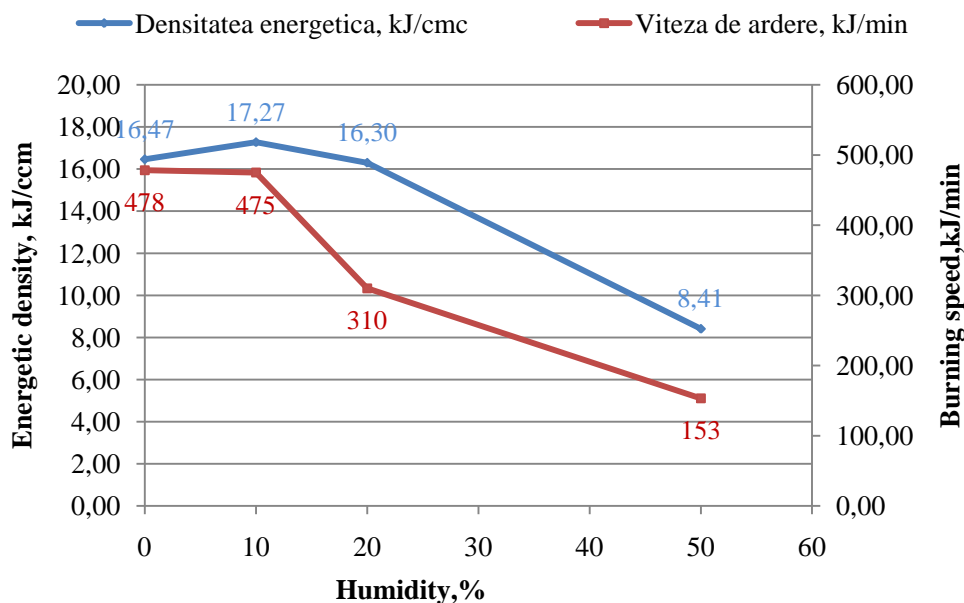
Fig. 5. *Variation energetic density for fagus silvatica*

For *aesculus hipocastanum*, m1 = 0,6200 g, U = 0%, gross calorific value is 19567 kJ/kg, net calorific value is 19094kJ/kg, energy density = 16,643 kJ/cm^3, m2 = 1,0500g, U = 10 %, gross calorific value is 17491 kJ/kg, net calorific value is 17302 kJ/kg, energy density = 16,541 kJ/cm^3, m3 = 1,0800 g, U = 20%, gross calorific value is 15653 kJ/kg, net calorific value is 15274 kJ/kg, energy density = 15,106 kJ/cm^3, m4 = 1,1200 g, U=50%, gross calorific value is 10137 kJ/kg, net calorific value is 9190 kJ/kg, energy density = 9,355 kJ/cm^3.

In fig.6 is presented variation of energetic density for *aesculus hipocastanum.*
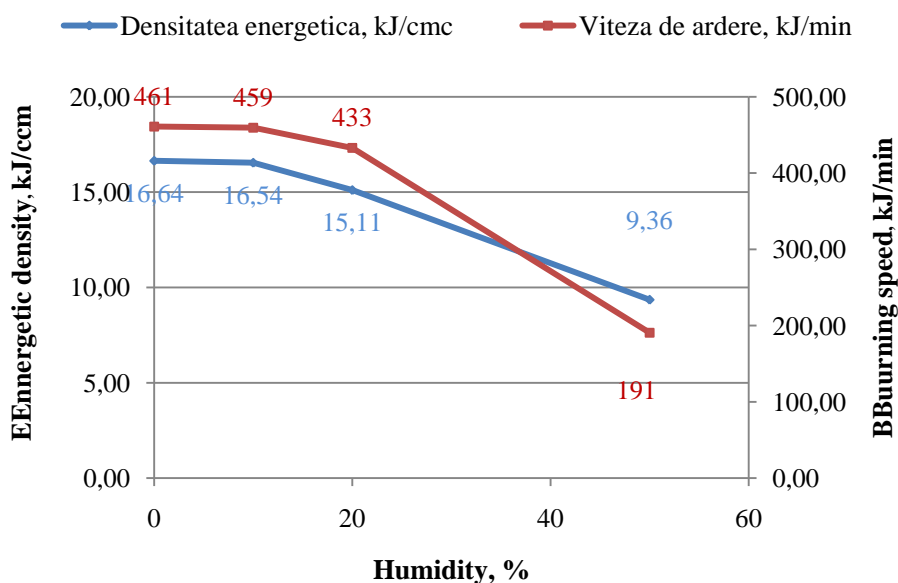
Fig.6. *Variation energetic density for aesculus hipocastanum*

Conclusions

The unfavourable physical properties of biomass use, dictated by large storage spaces, further compromise the economic use of biomass as the raw material;

Storing a large quantity of wet biomass will increase spending by the high rate of loss of dry matter due to microbial activity and the danger of self-ignition;

The advantages of using wood biomass as solid fuel, with low moisture content, have been highlighted in order to extract the highest amount of heat from the energy material used.

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COMPARATIVE STUDY REGARDING THE ANTIOXIDANT ACTIVITY OF *EUCALYPTUS, MENTHA PIPERITA AND HIPPOPHAE RHAMNOIDES*

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Abstract: The paper presents a review of antioxidant activity of Eucalyptus, Mentha piperita and Hippophae rhamnoides which is detailed in previous chapter. In the first part of the study the biological importance of plants was appreciated, the most common being the antioxidant, antimicrobial, antibacterial and antifungal activity. For the antioxidant activity test, the three types of methods described in the last part of the article Spectrometry (DPPH, ABTS, FRAP, PFRAP, CUPRAC, ORAC, HORAC, TRAP, Fluorimetry), Electrochemical Techniques (Cyclic voltammetry, Amperometry, Biamperometry), Chromatography(Gas chromatography, High performance liquid chromatography). Spectometry methods were used in most of the scientific papers that have been studied.

Keywords: antioxidant activity, Eucalyptus, Mentha piperita, Hippophae rhamnoides

1. Introduction

The recent growth in the knowledge of free radicals and reactive oxygen species in biology is producing a medical revolution that promises a new age of health and disease management [2]. Antioxidant effects depend on chemical antioxidant structure, physico-chemical properties (solubility, partition coefficient) and medium properties (type of solvent, pH) [15, 33]. Growing interest in nonsynthesized food additives has led to the use of natural compounds, such as essential oils [17].

The use of essential oils from differet plants is as an extremely useful technology given the wide range of chemical compounds present in its composition that are capable of inhibiting the growth of bacteria, yeasts, and acting as antioxidants. The objective of this study, therefore, is to provide an overview of the antioxidant properties of essential oils from Eucalyptus, Mentha piperita, Hippophae rhamnoides , with scientific and technological relevant approaches to the possible use of these substances in developing food systems.

2. Biological importance

Eucalyptus, large genus of mostly very large trees, of the myrtle family (Myrtaceae), native to Australia, Tasmania, and nearby islands. More than 500 species have been described. In Australia the eucalypti are commonly known as gum trees or stringybark trees. Many species are cultivated widely throughout the temperate regions of the world as shade trees or in forestry plantations. Economically, eucalyptus trees constitute the most valuable group within the order Myrtales [47].

Eucalyptus oil is readily steam distilled from the leaves and can be used for cleaning and as an industrial solvent, as an antiseptic, for deodorising, and in very small quantities in food supplements, especially sweets, cough drops, toothpaste and decongestants. It has insect repellent properties (Jahn 1991 a, b; 1992), and is an active ingredient in some commercial mosquito repellents (Fradin & Day 2002). Eucalyptus globulus is the principal source of eucalyptus oil worldwide [44].

Studies done says that *Eucalyptus* species are well known as medicinal plants because of their biological and pharmacological properties as anesthetic, anodyne, antiseptic, astringent, deodorant, diaphoretic, disinfectant, expectorant, febrifuge, fumigant, hemostat, inhalant, insect repellant, preventative, rubefacient, sedative yet stimulant, vermifuge, for a folk remedy for abscess, arthritis, asthma, boils, bronchitis, burns, cancer, diabetes, diarrhea, diphtheria, dysentery, encephalitis, enteritis, erysipelas, fever, flu,

inflammation, laryngalgia, laryngitis, leprosy, malaria, mastitis, miasma, pharygnitis, phthisis, rhinitis, sores, sore throat, spasms, trachalgia, worms, and wounds [7,11].

Sometimes their demand is also high in the soap and cosmetic industries [8].

Fig. 1. *Eucalyptus* [51]

Peppermint (*Mentha piperita*, also known as Mentha balsamea Wild.) [42]. Indigenous to Europe and the Middle East the plant is now widely spread and cultivated in many regions of the world [4]. It is occasionally found in the wild with its parent species.

Fresh or dried peppermint leaves are often used alone in peppermint tea or with other herbs in herbal teas (tisanes, infusions). Peppermint is used for flavouring ice cream, candy, fruit preserves, alcoholic beverages, chewing gum, toothpaste, and some shampoos, soaps and skin care products [31].

Peppermint oil is under preliminary research for its potential as a short-term treatment for irritable bowel syndrome, [22,37] and has supposed uses in traditional medicine for minor ailments. Peppermint oil and leaves have a cooling effect when used topically for muscle pain, nerve pain, relief from itching, or as a fragrance. As an aroma, peppermint may have memory- and alertness-enhancing properties [29, 49].

Fig. 2. *Mentha piperita* [52]

Hippophae rhamnoides, also known as common sea buckthorn is a species of flowering plant in the family Elaeagnaceae, native to the cold-temperate regions of Europe and Asia [26]. It is a spiny deciduous shrub. The plant is used in food and cosmetics industries, in traditional medicine, as animal fodder, and for ecological purposes. Sea buckthorn fruit consists of sugars, sugar alcohols, fruit acids, vitamins (C, E, and K), polyphenols, carotenoids, fiber, amino acids, minerals, and plant sterols [26]. Species belonging to genus Hippophae accumulate oil

both in soft parts and in seed of the fruit. Oil content in soft parts is 1.5–3.0%, while in seed this is 11% of the fresh weight.

The fruit of the plant has a high vitamin C content – in a range of 114 to 1550 mg per 100 grams with an average content (695 mg per 100 grams), placing sea buckthorn fruit among the most enriched plant sources of vitamin C [1].

Additionally, fruits have high concentrations of carotenoids, [5] vitamin E [19] and vitamin K [17]. The main carotenoids are beta-carotene, zeaxanthin and lycopene [21] while alpha-

tocopherol is the major vitamin E compound.[22] H. rhamnoides is a very versatile plant and the fruits as well as the leaves can be used.

The fruits are processed and then used in the food industry, in traditional medicine, as part of drugs or in the cosmetic industry. The leaves can be used as feed, particularly for ruminants. Because of its tolerance against strongly eroded, nutrient poor and sometime salty soils, the plant is also used for land reclamation or as shelterbelt [50].

Fig.3. *Hippophae rhamnoides* [53]

3. Antioxidant activity
3.1.Antioxidant activity of *Eucalyptus*

The antioxidant activity of essential *Eucalyptus* oil tested concluded, according to the table, E.globulus leaves extracts are an important source of antioxidant compounds. The antioxidant potency of acetone, ethanol and methanol extracts depends on the in vitro techniques. The highest in vitro antioxidant activity by ABTS and CUPRAC methods was for acetone extracts and for activity determined by DPPH method was for methanol extract. The highest values for FRAP and TFPH methods were in ethanol extracts.

Table 1. *Antioxidant activity of extracts of Eucalyptus globulus leaves assessed by ABTS, CUPRAC, DPPH, FRAP and TFPH assays.*

	ABTS TE, mmol g^{-1}DW	CUPRAC TE, mmol g^{-1}DW	DPPH TE, mmol g^{-1}DW	FRAP TE, mmol g^{-1}DW	TFPH TE, mmol g^{-1}DW
Acetone extract	10.06 ± 0.44^b	$3.65 \pm 0.10^{b,c}$	0.97 ± 0.01^c	1.31 ± 0.19^b	1.13 ± 0.10^b
Ethanol extract	$1.69 \pm 0.07^{a,c}$	$0.48 \pm 0.03^{a,c}$	0.96 ± 0.04^c	$9.79 \pm 0.24^{a,c}$	$1.78 \pm 0.07^{a,c}$
Methanol extract	9.91 ± 0.32^b	$2.69 \pm 0.08^{a,b}$	$1.56 \pm 0.03^{a,b}$	1.10 ± 0.08^b	0.91 ± 0.13^b

Statistical significances of antioxidant capacities values are shown in superscripts letters: a statistically significant differences versus values of acetone extract; b versus values

of ethanol extract and c versus values of methanol extract ($p < 0.05$) [16]. In another

study, the antioxidant activity of the essential oils from E. globulus leaves was estimated by DPPH, reducing power, and inhibition of lipid peroxidation tests. The result of research done shows that Eucalyptus has weak antioxidant activity [25].

3.2. Antioxidant activity of *Mentha piperita*

According to an article published in the Arabian Journal of Chemistry that united the results in Table 2 obtained through evaluation the essential oil and different extracts of M. piperita were explored for antioxidant activity by evaluating their antioxidant capacity, DPPH free radical scavenging activity and reducing power, Chloroform extract and peppermint oil showed almost equal antioxidant potency [35].

Table 2. *The results of antioxidant screening of oil and leaves extracts of M. piperita.* [35]

Sample	Antioxidant capacity at 734 nm (%)	DPPH free radical scavenging activity (%)	Reducing power (absorbance 700 nm)
Peppermint oil	89.4 ± 6.3	92.6 ± 6.8	0.9 ± 0.3
Pet. ether extract	73.6 ± 8.2	71.3 ± 9.1	0.6 ± 0.5
Chloroform extract	91.2 ± 5.6	91.8 ± 5.8	0.8 ± 0.3
Ethyl acetate extract	87.8 ± 6.6	84.9 ± 4.2	0.8 ± 0.1
Ethanol extract	76.2 ± 4.5	74.8 ± 5.2	0.7 ± 0.1
Aqueous extract	69.8 ± 5.2	70.3 ± 6.1	0.4 ± 0.3

In an article that investigated total phenolic content and antioxidant activity of six wild Mentha species from northeast of Algeria it was concluded that the methanol extracts were rich in phenolic compounds and exhibited high antioxidant activity ranging from 7.5 μg/mL to 44.66 μg/mL, which varied depending on the species, Mentha piperita has good antioxidant activity and can be used as natural antioxidant source [4].

3.3. Antioxidant activity of *Hippophae rhamnoides*

Researchers who analyzed, antioxidant and radical scavenging activities in fruits of 6 sea buckthorn cultivars was measured antioxidant capacity by the DPPH test. The highest antioxidant capacity was found in the Ljubitelna cultivar which is of Russian origin [36].

Tabel 3. *Total phenolic contents (g GAE kg–1 FM), antioxidant capacity (g AAE kg–1 FM) of fruits of particular sea buckthorn cultivars;* [36]

Cultivar	Total phenolic content	Antioxidant capacity
Botanicky	9.31 ± 1.02 a	11.26 ± 1.29 a
Buchlovicky	8.62 ± 1.51 a	12.85 ± 1.95 a
Hergo	9.65 ± 1.34 a	11.58 ± 1.11 a
Leicora	9.74 ± 1.20 a	11.50 ± 1.26 a
Ljubitelna	14.01 ± 1.65 b	18.11 ± 1.74 b
Trofimovskij	14.17 ± 1.43 b	17.38 ± 1.41 b

*Different letters in each column indicate significant differences in means at $P < 0.05$ according to Tukey's test.

Another study who evaluated antioxidant activity of Seabuckthorn (Hippophae rhamnoides L.) leaves concluded that this plant possesses this activity [24,34].

4. Methods

Antioxidant capacity assay	Principle of the method	End-product determination
Spectrometry		
DPPH	Antioxidant reaction with an organic radical	Colorimetry
ABTS	Antioxidant reaction with an organic cation radical	Colorimetry

FRAP	Antioxidant reaction with a Fe(III) complex	Colorimetry
PFRAP	Potassium ferricyanide reduction by antioxidant and subsequent reaction of potassium ferrocyanide with Fe 3++	Colorimetry
CUPRAC	Cu (II)reduction to Cu (I) by antioxidants	Colorimetry
ORAC	Antioxidant reaction with peroxyl radicals, induced by AAPH (2,2'-azobis-2-amidino-propane)	Loss of fluorescence of fluorescein
HORAC	Antioxidant capacity to quench OH radicals generate by a Co(ii) based Fenton-like system	Loss of fluorescence of fluorescein
TRAP	Antioxidant capacity to scavenge luminol-derived radicals, generated from AAAPH decomposition	Chemiluminescence quenching
Fluorimetry	Emission of light by a substance that has absorbed light or other electromagnetic radiation of a different wavelength	Recording of fluorescence excitation/emission spectra
Electrochemical Techniques		
Cyclic voltammetry	The potential of a working electrode is linearly varied from an initial value to a final value and back, and the respective current intensity is recorded	Measurement of the intensity of the cathodic/ anodic peak
Amperometry	The potential of the working electrode is set at a fixed value with respect to a reference electrode	Measurement of the intensity of the current generated by the oxidation/ reduction of an electroactive analyte
Biamperometry	The reaction of the analyte (antioxidant) with the oxidized form of a reversible indicating redox couple	Measurement of the current flowing between two identical working electrodes, at a small potential difference and immersed in a solution containing the analysed sample and a reversible redox couple
Chromatography		
Gas chromatography	Separation of the compounds in a mixture is based on the repartition between a liquid stationary phase and a gas mobile phase	Flame ionisation or thermal conductivity detection
High performance liquid chromatography	Separation of the compounds in a mixture is based on the repartition between a solid stationary phase and a liquid mobile phase with different polarities, at high flow rate and pressure of the mobile phase	UV-VIS (e.g. diode array) detection, fluorescence, mass spectrometry or electrochemical detection

Conclusions

In conclusion, from the researches that have been taken into consideration for this review, it follows that the three plants*: Eucalyptus, Mentha piperita* and *Hippophae rhamnoides* show the antioxidant activity in different proportions.
The result of research done shows that *Eucalyptus* has weak antioxidant activity.
Mentha piperita has good antioxidant activity and can be used as natural antioxidant source and *Hippophae rhamnoides* possess this biological activity. For the determination of the antioxidant capacity were used various methods over time, being three classes of methods: Spectrometry, Electrochemical Techniques, Chromatography, the most used being Spectrometry Methods and from this classes, the most common method of determining the antioxidant activity is DPPH which working principle is antioxidant reaction with an organic radical.

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NETWORK ANALYSIS OF SCIENTIFIC ARTICLES ON GENETICALLY MODIFIED ORGANISMS

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Abstract: *This article deals with the analysis of documents written after 1985 as a result of individual or group work. Our sample is based on 1,375 articles published over the past 34 years using the keyword "GMO". The network analysis research reveals the extent to which author relationships have developed during publications, ie whether they are published in larger or smaller groups, or whether independent work is typical of publications on genetically modified organisms. The results show whether we can name the authors who determine the topic.*

Keywords: *network analysis, GMO, scientific articles*

1. Introduction

The topic of our research is the presentation of genetically modified organisms and the analysis of the co-author and citation network of publications on this GMO. Nowadays, the issue of genetic modification is becoming more and more popular due to the growing population and possible future nutritional problems. This is a topic that is very divisive and almost always a topical issue.

The objective of this article is to answer the following questions:

− Can the proliferation of genetically modified organisms provide benefits that can reduce or even eliminate public nutrition problems?
− Will genetically modified organisms completely drive out smallholders who will not be able to compete and will not be able to survive?
− Why do you share people's opinions?
− Is this the future of crop production?
− Will the genetic modification not only be accepted but supported everywhere for years?
− Are there significant author clicks among the authors who publish the topic?

In our research we use the network analysis method, which was applied to the data queried from Scopus.

2. Genetic Modification

Gene modification is not too old. The first research was started in California in 1972 and it was successful. The product of research has fundamentally changed the mindset of scientists and opened new gates for society. There has been no unanimous opinion on these radical discoveries for the last almost half a century. This theme divides people, countries and the whole earth. The new research, scientific name: invitro DNA recombination, is widely known. Perhaps the most common are gene manipulation, genetic modification and genetic engineering (Venetianer, 1998).

According to the law, organisms, whether plants or animals, are considered to be genetically modified organisms that could not have been produced as a result of natural reproduction. This definition carries truth, but it is by no means irrefutable. It is true that there are genetically modified organisms that did not naturally occur, but in today's scientific application, using genetic engineering, they create organisms that could have evolved in nature as a result of a much slower process (Venetianer, 2010).

The structure of the genetic material is the same throughout wildlife, so scientists have come to the conclusion that genes in DNA are freely interchangeable. Based on this assumption, scientists have also developed a method for this "exchange": They must cut the DNA chain at a predetermined location, attach the desired portion, and reconnect the chain.

This technique is nowadays almost indispensable in agronomic research and development. This method is known as Genetically Modified Organisms, or Genetically Modified Organism, or GMO. (Sain and Erdei, 1985).

The most important step in the process of gene modification, that is, the key step, is to introduce the gene construct that has been prepared in advance by scientists in the laboratory. This gene construct is called a transgene. (Dudits and Heszky, 2000).

Genetically modified crops are gaining ground, although they are still banned in many countries. These plants became commercially available only a few years before the turn of the millennium. Since then, we have seen rapid growth year on year. In 1996, GM crops grew from 1.7 million hectares to 125 million hectares in 2008, accounting for 8% of agricultural production. In 2016, this figure had risen to 185 million hectares. (Klebercz, 2018).
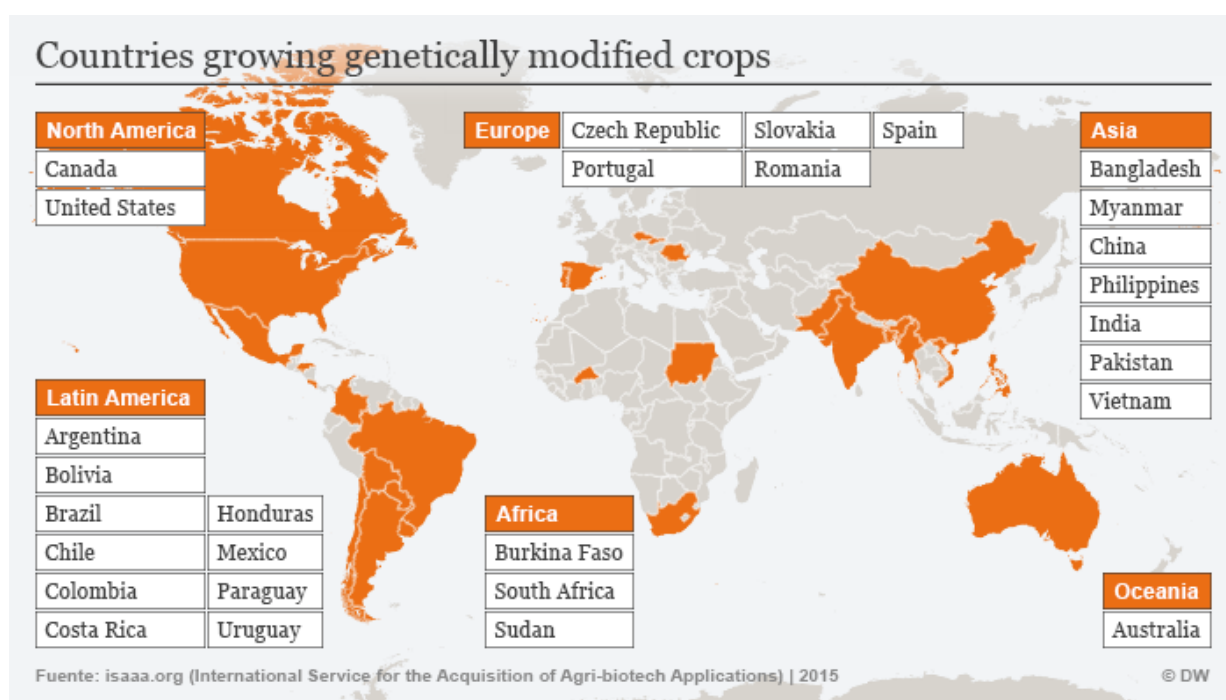

Fig. 1. *Countries growing genetically modified crops*
Source: https://www.dw.com/en/global-gmo-cultivation-dipped-in-2015/a-19190800

Figure 3 shows which countries on our planet are allowed to grow GM crops. Today, transgenic plants are cultivated on over 16 million hectares in 28 countries. The most important of these countries are: USA, Argentina, Brazil, Canada, India China, Paraguay and South Africa. They are the world's leading countries in terms of genetically modified crop production.

3. GMOs in the European Union

In the European Union, only food or food raw materials that have previously been officially approved may be produced or placed on the market. Currently, the authorization of the placing on the market of GMOs is not a Member State competence. However, it is up to the Member States to decide on the release for experimental purposes. Since the amendment of Directive 2001/18 / EC in 2015, Member States can define the cultivation of GM plants authorized in the European Union on their territory.

Thus, once a transgenic organism has been authorized in the EU Parliament, it can circulate throughout the EU due to the free movement of goods. Where GMO is used as a raw material in processing, it shall be labeled on the packaging as specified by the Union. Some products of animal origin are exempt from the labeling obligation, such as milk, eggs or meat of animals fed with GM feed. Member States may regulate in their respective countries the cases in which GMO-free status may be indicated.

Currently, two plants modified by genetic engineering in the European Union are authorized to grow: MON810 GM corn and Amflora GM potato.
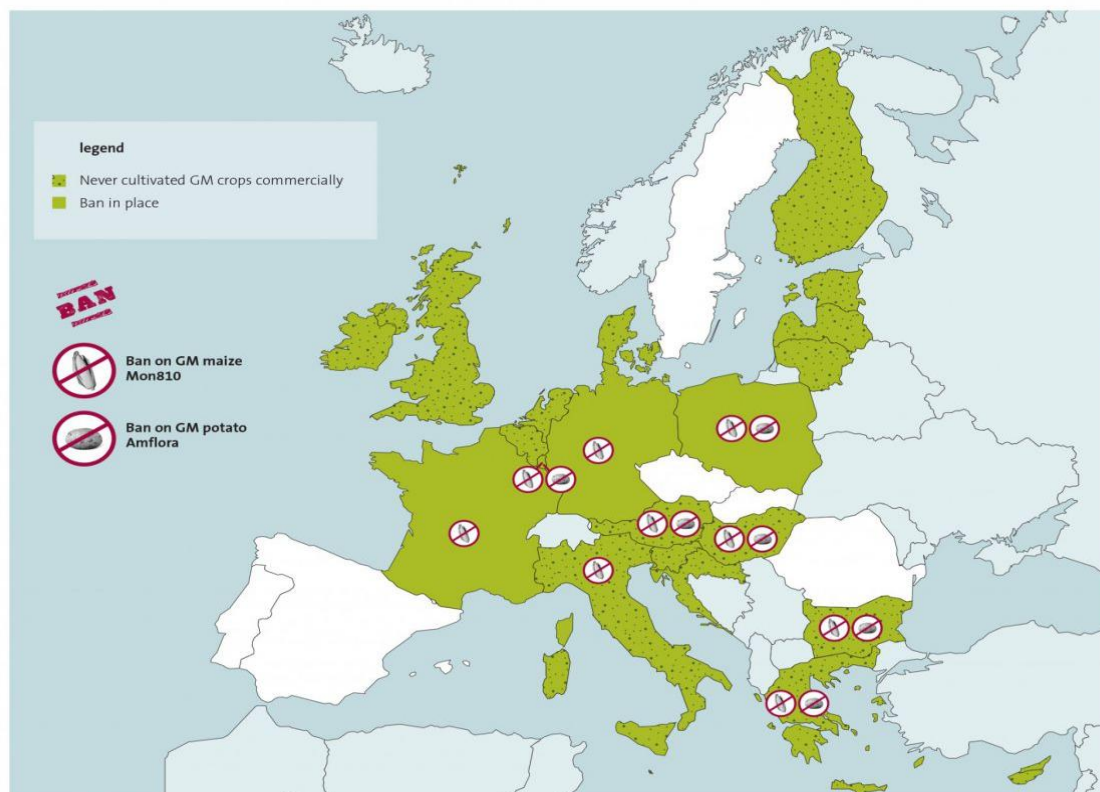

Fig. 2. *European countries' position on MON810 and Amflora*
Source: https://www.dw.com/en/global-gmo-cultivation-dipped-in-2015/a-19190800

Figure 2 shows in which countries the cultivation of the above two plants is prohibited. Green dotted areas, though, represent countries where transgenic plants, GMOs, have never been commercialized.

4. Material and Method

Nowadays, the analysis of network structures is receiving increasing attention. This is due, on the one hand, to the growing importance of personal relationships and, on the other hand, to the fact that methods of examining social networks have undergone significant development in recent years. At the beginning of the 20th century Lissoni and Breschi argued for the importance of personal relationships and stated that these contacts are by no means negligible as they have multiple effects on world events.

Graph theory is the cornerstone of network analysis. Graphs are mathematical structures that do not occur in small numbers in, for example, computer science. It can be a graph on the Internet, an electronic network or even human relationships can be understood as graphs (Freeman, 1979; Wasserman and Faust, 1994).

If we use graphs, we can observe a pattern of connection networks. It is important to know that the position of the points and the shape and length of the lines connecting them have no information. In such cases, the line represents the set of mathematically received points on the plane such that the edges appear only once. In network analysis, graph theory, and the use of graphs, is essential to identify the most important individuals in a given network. The most important publishers are the researchers who have the most authorial links. They are located at strategic points in the network. (Popp et al, 2015)

Frigyes Karinthy dealt with the network of human relationships in the late 1920s. In 1929 he published his short story "Chains", in which he described the "six steps distance" theory. It simply means that if there were two people randomly selected at that time in the world, there would have been a maximum of 6 people through whom they could know each other. That is, any person could reach anyone through a maximum of six people. The point of the theory is that the number of relationships between people increases as the chain links increase. This way, the entire population can be reached with the help of a few

friends. This research was also carried out by social psychologist Stanley Milgram some 40 years later. His subjects were Kansas people, who were asked to try to send a letter they had written to a person in Massachusetts. Each subject forwarded the letter to a person whom they believed to know the person or may be geographically closer to each other. By then, 40 out of 160 mailings had arrived. The number of mediators was between two and eleven, that is, three to twelve steps apart.

However, these data are outdated as we are now in the heyday of technology and the internet. When Karinthy was examining graphs, there was much less familiarity with a person, and there were no community portals.

In 2018, when everyone is online twenty-four hours a day, these social networks have dwindled. The largest community site also made this calculation in 2011. As a result, the six-step distance was reduced to 3.74 steps. Five years later, in 2016, when their number of users doubled compared to 2011, they recalculated the 12th anniversary of its existence. And the result was even less. There are 3.57 steps between people. If the number of Internet users is still increasing, will that number fall below 3.0? Is this a good thing or a bad thing? The world is really just one block away from us (Barabási, 2013).

Authors often associate, always for a specific purpose. This may be the case, for example, for organizational reasons, there is a need for higher capital investments, in many cases partnerships also result in fewer errors and increased productivity, or due to limitations in the availability of certain equipment. In the case of authors' associations, researchers play two significantly different roles. In such cases, one can clearly see the role of leader and follower. The name of the follower appears after the name of the leader at the time of publication. The results of some researches have shown that, as a result of publishing collaboration, research work has an additive effect on personal performance, and thus the output produced increases. We can state that writing and / or research groups or individual publishers within a topic provide us, in a sense, with a network of contacts. In this case, the relationship between them is nothing more than co-operation between authors on a common topic.

Analysis of social networks can be achieved by analyzing the structural characteristics of the network. We can identify the key features of social networks as the users and their connections (Oinas-Kukkonen et al, 2010). These links create the structure of the network. While not without their accompanying problems, as noted by (Batool and Niazi, 2014), structural and topological attributes have been used in several studies to understand the nuances and the importance of human behavior in social networks (Shapiro and Varian, 2013).

Social Network Analysis (SNA) has developed as a specialty in parallel with scientometrics since the end of the 1970s. In a foundational work, (Freeman, 1977) developed a set of measures of centrality based on betweenness. Freeman stated that "betweenness" as a structural characteristic of communication was described in the literature as the first measure of centrality (Bavelas, 1948; Shimbel, 1953). The SNA point of view on social relationships in terms of network theory can consist of nodes and ties (also called edges, links, or connections). Nodes (or, as they are called in the ferial usage: junctions) are the individual actors creating the networks, and ties are the relationships between them. The resulting graph-based structures are often very complex. We can state that research in several academic fields has shown that social networks operate on different levels and play a crucial role in determining the way problems are solved, organizations are run, and the degree to which individuals succeed in achieving their goals (Scott, 2017, Várallyai, 2015).

In this paper, we analyze the relationship between genetically modified organisms throughout the world. The method of analysis is network analysis. From 1985 to the present we have been publishing, writing or related to this topic. This means analyzing a total of 1,375 publications. As a result of our analysis, we can find out when they started to openly deal with genetic modification, both in animals and plants. We would also like to mention which country's population is most active in this topic and the possible relationships between them. An examination of the social network gives an answer to the extent of the author's relationships with the publications. The results show whether we can name the authors who determine the topic.

5. Results and discussion

Figure 3 was made using data from our database. The blue dots indicate how many publications were made using the GMO keyword. From this we can read that 1985 was the first such publication. During this period, gene modification and transgene insertion were still in a very rudimentary phase. In the following three years no scientific article on this subject was published. From 1989 we can say that the authors dealt regularly with this subject, although there was a break in the year or two. We can definitely say that at the turn of the millennium there was a major breakthrough in this field of research, as 20

articles were published in 2000. Most publications were published in 2014. Here is the highest point of the blue line. At that time, 104 articles were published, bringing the number of publications so far to over one thousand. From here on, a certain decline can be observed.
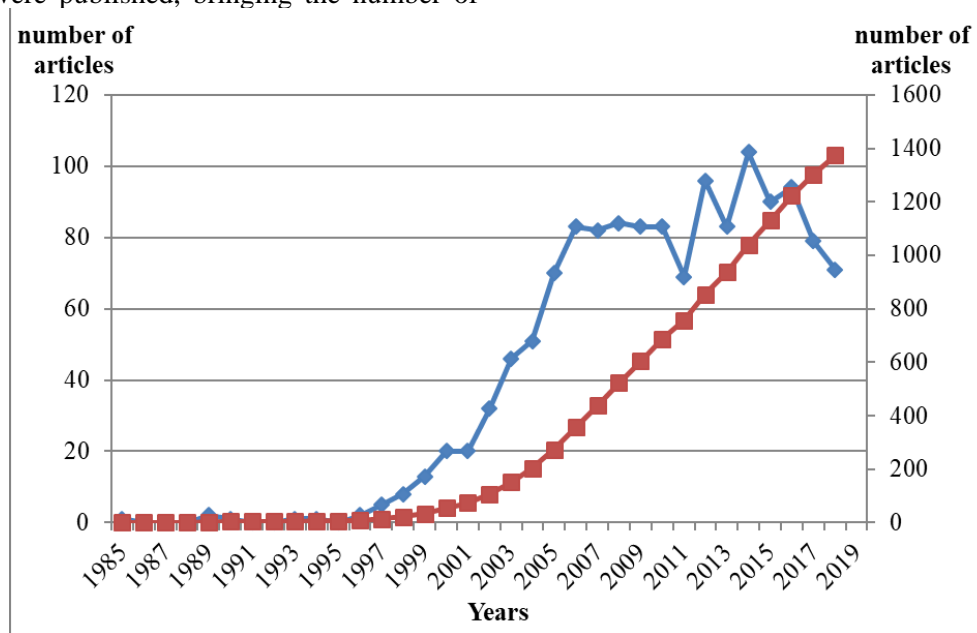

Fig. 3. *Number of publications on the topic between 1985 and 2018*

From 1985 to the present, 1,375 publications come from a total of 75 different countries. These include those with 1 to 1 appearances, but there are also countries where this is over 100.
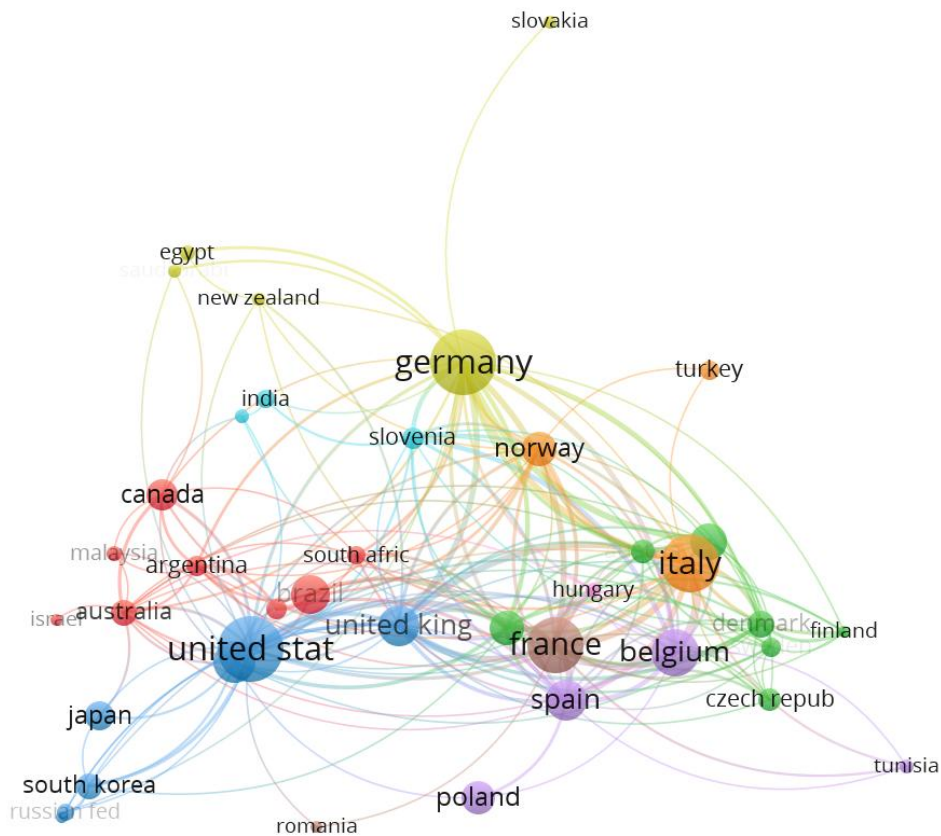

Fig. 4. *Cooperation Network of countries publishing at least 5 articles*

Figure 4 shows the network resulting from my analysis of the social network. This graph illustrates authors from certain countries who were in contact with other countries at the time of publication. The size of the dots illustrates the number of publications in a given country. So here we can read that the United States of America is the source of most publications and that the US has a huge network of contacts. Its collaborative network is represented by the blue lines, so it was clearly readable and detectable in some research with Japan, South Korea, Russia and the United Kingdom. Outside of these countries, it is clear that the United States has established a network of collaborations with many other countries on the issue of gene modification in journals.

In many cases, authors associate themselves in a research for various reasons in order to achieve certain goals. In such cases, co-authors can reap many benefits. There are studies that require more capital, so if you are working on a project, you may be able to share the cost of the process. By associating with the "more eyes see more" principle, we can reduce the number of errors that

occur and the effectiveness increases with authoring partnerships. In some cases, partnerships are necessary because some professionals have more tools. It is also possible that one part of the research equipment is provided by one scientist and the other part by another. Even so, it is a huge step if the authors find common ground and can work together.

In the case of authors' associations, researchers play two significantly different roles. In such cases the role of the leader and the follower can be clearly observed. In the case of publication, the name of the follower is followed by the name of the leader.

Some studies have shown that, as a result of publishing collaborations, collaborative scientific work exerts a stimulating effect on researchers' performance, thereby increasing their output.

We can state that writing and / or research groups or individual publishers within a topic provide us, in a sense, with a network of contacts. In this case, the relationship between them is nothing more than a collaboration between authors on a common topic.
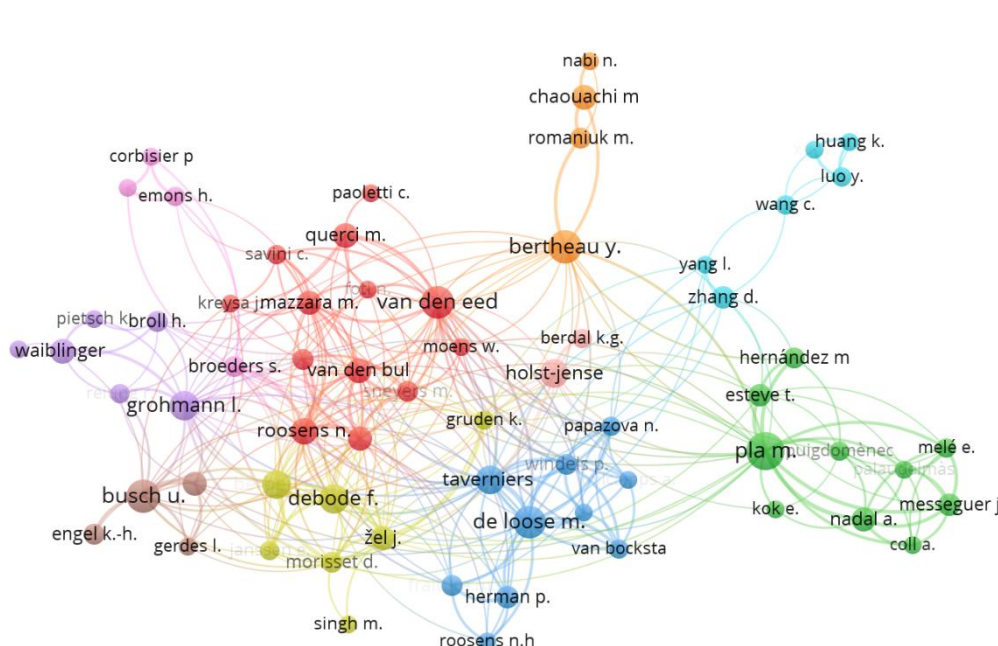
Fig. 5. *Co-author network based on authors who publish at least 5 articles*

Figure 5 illustrates the relationship between authors co-authored on the subject of genetically modified organisms (GMOs). Only authors who have published at least five times using that keyword are shown in this chart, who are demonstrably knowledgeable in the subject. Of the 3,545 authors, 123 met this condition, meaning that they had published at least five times on a given topic. So, the higher the score,

the more articles on gene modification from 1985 to the present. The same colors mean groups of authors.

The 1,375 publications contain 8,050 keywords. We looked at the frequency of keywords other than the GMO keyword. This is illustrated in Figure 6. As you can see, genetic is the most common word, it appears 499 times as a named keyword. In more than three hundred

cases we find the words modified and organism. The explanation is very simple, these three words give the acronym GMO. The keyword 'food' appears in 256 cases.

Fig. 6. *Number of occurrences of keywords*

The next two words are quite interesting next to each other. And this is safe, which means risk in our mother tongue. Risk is found in 142 cases, while safe is found in 153 cases. This does not allow a clear conclusion to be drawn that, according to statistics, more people consider it safe than risky because the difference between the two values is very small. It also demonstrates the divergent views people have on genetically modified organisms. From these data, we can conclude that the introduction of transgene into a living entity is not the only topic of discussion worldwide.

Other keywords have a much lower occurrence than the ones mentioned above. 82 times the environment as an environment occurs. BT 78 times. These articles deal with the BT maize mentioned in Chapter One. It is also interesting that the word toxic is found in 17 cases. From this we can conclude that GMOs are not toxic in the opinion of the researchers.

Fig. 7. *Co-occurrence network of terms*

Figure 7 illustrates the co-occurrence of keywords. There were 25,238 terms in the title and abstract of the publications. This is again an unprocessed amount, so we have narrowed it down to those that occur in at least 30 cases. This search returned 178 results. The size of the points

is proportional to the number of occurrences of the given terms. Groupings are indicated by colors. According to this, there are two large groups, red and green, and we can observe a smaller group, blue. You can see that in the red group, a prominent group of keywords is live rotation such as crop, effect, plant, use development and many other words related to the technique used. While the keywords in the green group are more related to crop production. Examples of such words are gmo, organism or soybean.

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EXAMINATION OF INTERNATIONAL AGRICULTURAL TRADE LITERATURE BY SOCIAL NETWORK ANALYSIS

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Abstract: *In my study, I explore the relationship between scientific articles examining international agricultural trade by network analysis. The basis for my research was exported from Scopus, the largest multidisciplinary bibliographical abstract and citation search database. Our sample contains 1090 scientific articles published between 1970 and 2017. My goal is to get answers to the following questions. How the number of articles has developed over the years, which countries are most concerned with international agricultural trade. In a network between countries, a cluster can be observed, or each country can search independently. I am looking for answers to the authors of the publications, what is their relationship with each other; are you searching alone or in groups; Is there a major author on the subject. I processed to my database with social network analysis and the VOSviewer software. The application is a tool for building and displaying bibliometric networks. The analysis of network connections and structures became popular in the field of sociology, whereby the term Social Network Analysis (SNA) is derived. SNA is based on graph theory, which attempted to answer a part of network-related questions by developing the theory of random networks. The definition of a network is from a finite set of social actors and the relationships between them. The SNA point of view on social relationships in terms of network theory can consist of nodes and ties (also called edges, links, or connections). I have made some analyzes, these can be described in the following statements: There are some major authors on the subject. The authoring network shows, that smaller groups are created among authors. The authors' network also suggests that researchers are not only related to authors in their own countries. But also, everyone can interact with everyone by accelerating globalization.*

Keywords: *social network analysis, SNA, international agricultural trade, research group*

1. Introduction

The range of research to date shows that the organization is a group of individuals (Dobák and Antal, 2013). At the same time, the members of the organization perform their duties in various formal and informal groups. Human is a social being, so groups are created without creation. The past period proves that these groups represent an organizational competitive advantage. Leaders must be recognized, that they need to support the groups to complete the task. There are several definitions for defining a group. For the purposes of this discussion, we consider a group of two or more people who interact regularly to achieve a common goal. The sociometry is analyzing people's behavior or exploring their personal relationships with groups on a specific topic. This is an important tool of analysis of social pedagogy (Lengyel, Török and Füzesi, 2018). The analysis assesses the position of the people in the group relative to the rest of the group.

By definition, the network of relationships consists of a finite set of social actors and the relationships between them. Network analysis analyzes relationships between individuals, groups, organizations, and countries. The method is well suited for complex examination of complex social structures and their modeling (Wasserman and Faust, 1994). In my study, I explore the relationship between scientific articles examining international agricultural trade by network analysis. One of my assumptions is that small or large groups are formed in scientific life. My other assumption is that there are outstanding, decisive authors on the network.

Recent literature has been increasingly focusing on studying network structures. This interest was triggered by the development of a

network analysis methodology. The analysis of network connections and structures became popular in the field of sociology, whereby the term Social Network Analysis (SNA) is derived (Bollobás, 2001) (Erdős and Rényi, 1959).

The methodological basis of network-related research is graph theory, which attempted to answer a part of network-related questions by developing the theory of random networks. Graph theory (Kürtösi, 2004) is useful for analyzing network connections because it has the right vocabulary for describing network structures on the one hand and provides the mathematical basis for measurability of structural features on the other.

The graphs are good models of real network connections and are able to visualize relationship patterns that would otherwise remain undiscovered. Situations that are noticeable in the network are always complex and evolve over a longer period of time, their content observed at a given moment, or a result of an earlier decision or event (Gelei, 2008) (Hakansson and Ford, 2002).

2. Materials and Methods

In my study, I explore the relationship between scientific articles examining international agricultural trade by network analysis. The basis for my research was exported from Scopus, the largest multidisciplinary bibliographical abstract and citation search database (Erfanmanesh, 2017). Our sample contains 1090 scientific articles published between 1970 and 2017.

My goal is to get answers to the following questions and assumptions. My goal is to get answers to the following questions. How the number of articles has developed over the years, which countries are most concerned with international agricultural trade. In a network between countries, a cluster can be observed, or each country can search independently. While my

first assumption is that smaller or larger groups are formed in scientific life. My second assumption is that there are outstanding authors in the network.

My sample was determined using the following terms:

(KEY ("international trade" OR "world trade") AND KEY (agriculture OR agricultural)) AND PUBYEAR> 1969 AND PUBYEAR <2018 AND (LIMIT-TO (DOCTYPE, "OR"))

The condition states the following. The word "international trade" or "world trade" should be combined with the word "agriculture" or "agricultural". Of these filtering criteria, I examine only scientific publications published between 1970 and 2017. In the processing of my database, I used the linking analysis and the VOSviewer and Gephi software. VOSviewer is a software tool for constructing and visualizing bibliometric networks. It also offers text mining functionality that can be used to construct and visualize co-occurrence networks of important terms extracted from a body of scientific literature. While Gephi uses modularity to map clusters and network strengths within a network.

3. Results and Discussion

Number of articles and citations

It can be observed that by 2012 there was an increase in the number of publications. Technological advances have contributed to the emergence of new manufacturing processes, the launch of new products to the trade. And with the modernization and development of transportation and telecommunications, the delivery is getting to another country cheaper and faster. All this helped to increase the volume of international agricultural trade and more and more researchers have begun to examine world trade (Fig. 1.). After 2012, a minor decline can be observed, leading to a further investigation.
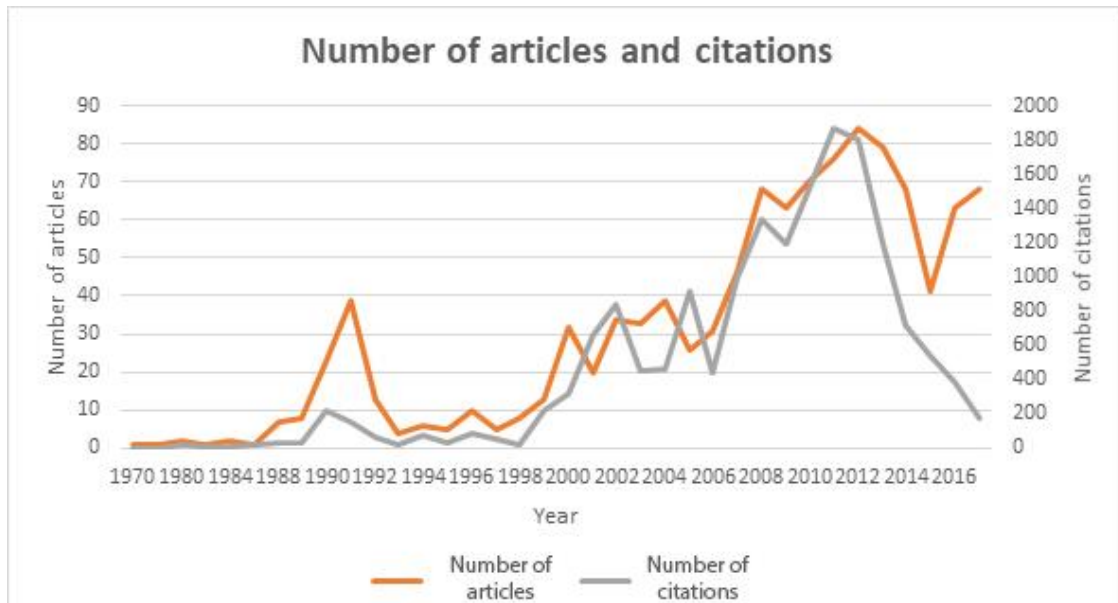
Fig. 1. *Number of articles and citations*

The citation refers to the number of references to articles in the sample. The number of citations, basically, follows the movement of the publication activity.

It should be noted here that in the last half of the period, the decrease in citations depends on the date of publication of the articles - the newer ones, of course, do not have as many references yet.
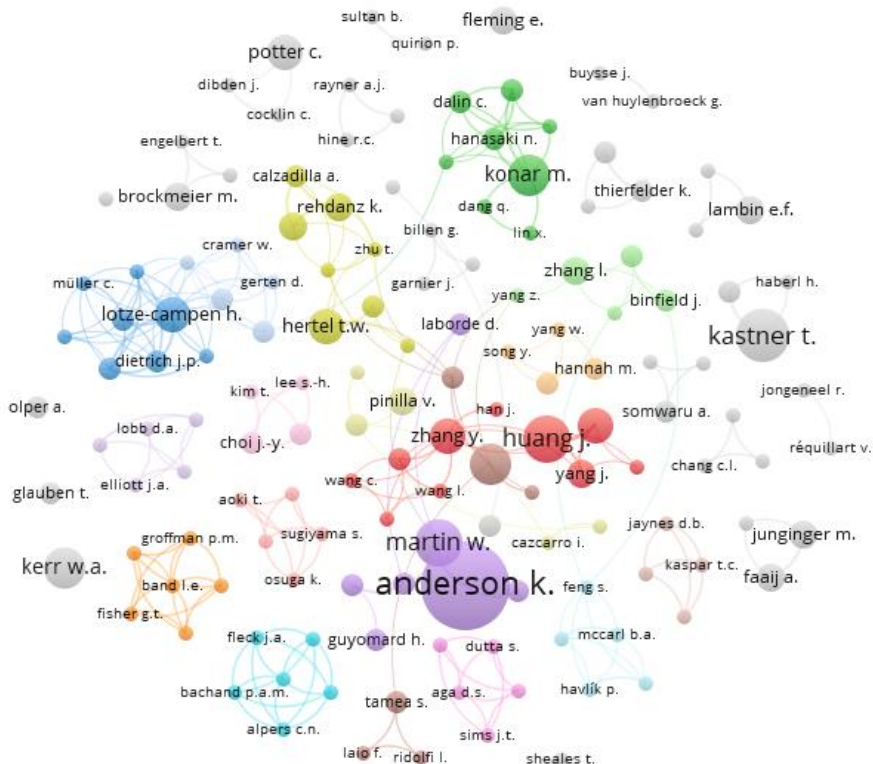
Co-authorship network

Fig 2. *Co-authorship network*

There are 2407 authors in the sample. During the creation of the net, the following narrowing was applied because of the better visualization: only those authors based on who are involved in at least two publications. It represents 301 authors and introduces a subnet (Fig. 2). The points represent the number of articles by the authors, while the edges represent the relationship between the authors.

I created another network (Fig. 3.). The points show the number of citations. It can be said during the investigation, that the authors form in smaller or larger groups. Of the 301 authors, only 51 were worked alone, while the other researchers were members of 55 different groups. This is well represented in Figures 2. and 3.. There are some major authors in the network. Outstanding authors in terms of the number of publications: Anderson, Konar, Kastner, Huang. After comparing Figures 2 and 3 it can be said. Potter does not play a prominent role in the co-authorship network, while he is the largest person in the citation network.
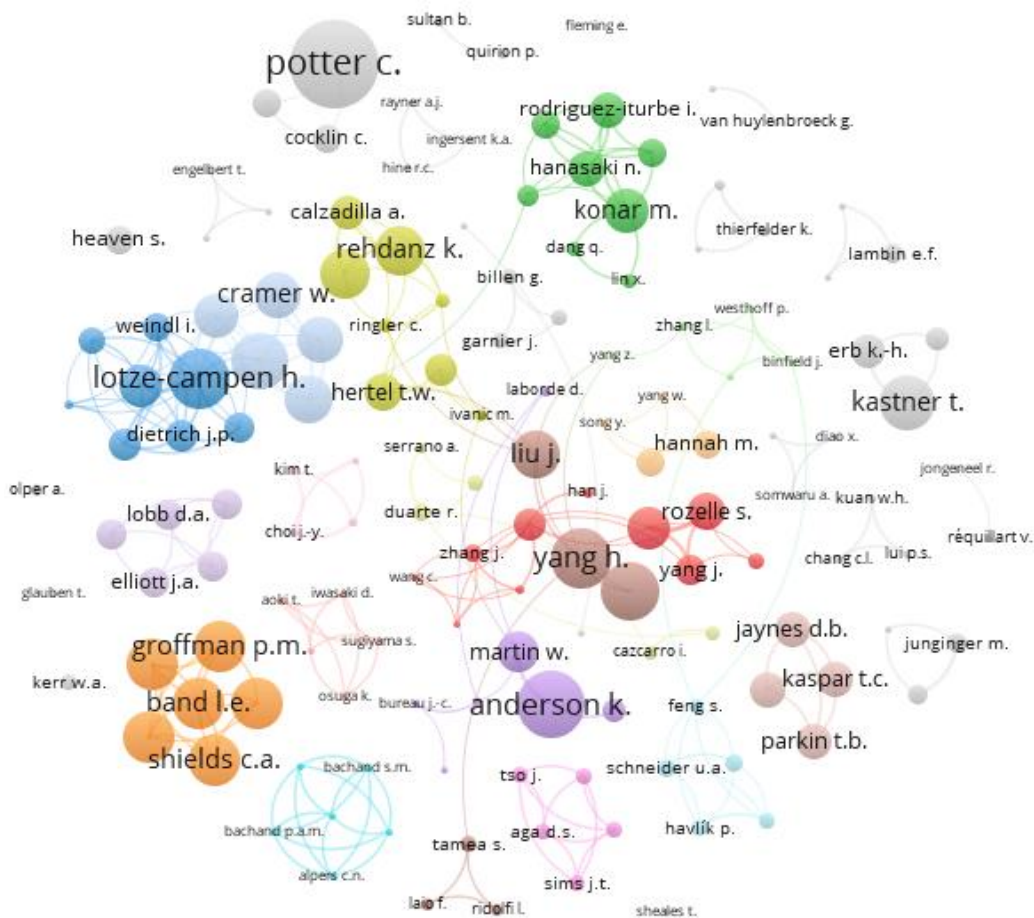

Fig. 3. *The network of authors' citation number*

Network of countries

I was looking for an answer to the question. Which countries are outstanding on this topic and how the network of countries looks like (Fig. 4.).

Based on the study, there are some countries that play an important role, such as USA, Canada, China, Germany, the Netherlands. The outstanding role is influenced by the area and population of countries. Therefore, it will provide an opportunity for a future study. Fig. 4. shows that groups are formed between different countries.

Index of network analysis

During my research, I examined a couple of indexes of network analysis:

- Degree: number of relationships;
- Closeness centrality: the number of steps that the selected point reaches all the points on the network;
- Betweenness centrality: assumes that a player is successful in a network because the player is in a mediating role between two groups. ;

- Pagerank: a procedure that not only shows who has been referred to but the centralities of referrers. The following figure shows the indexes of the top 10 authors. My second assumption is visible from the 1. table. Yes, there are actors who play a prominent role in publications on international agricultural trade.

Table 1. *Top 10 authors of indexes*

Author	No. of articles	Author	No. of citations	Author	Degree	Author	Betweenness centrality	Author	Page-rank
Anderson K.	14	Potter C:	557	Zhang Y.	25	Liu J.	1967	Kastner T.	0,003293
Kastner T.	8	Hoekstra A.Y.	520	Lotze-Campen H.	22	Yang Z.	1711	Zhang Y.	0,00303
Huang J.	7	Lenzen M.	407	Fader M.	21	Zhang L.	1575	Li Y.	0,003
Martin W.	7	Anderson K.	363	Suweis S.	19	Hertel T.W.	1366	Yang H.	0,002422
Yang H.	6	Yang H.	320	Diao X.	18	Feng S.	1207	Lotze-Campen H.	0,002167
Konar M.	6	Lotze-Campen H.	309	Elbehri A.	18	Ivanic M.	926	Huang J.	0,002024
Li Y.	6	Zehnder A.J.B.	302	Gehlhar M.	18	Martin W.	918	Glauben T.	0,001941
Kerr W.A.	6	Lucht W.	291	Gibson P.	18	Yang H.	817,5	Zhang J.	0,001862
Potter C.	5	Kastner T.	273	Leetmaa S.	18	Zhang Y.	803,67	Liu J.	0,001798
Lotze-Campen H.	5	Tilzey M.	261	Mitchell L.	18	Hoekstra A.Y.	780	Aguilera E.	0,001784

Conclusion

It can be said from the examination of 1090 scientific articles in international agricultural trade, that the number of publications is constantly increasing. More and more authors are writing about international agricultural trade. One of my assumptions is that there are smaller or larger groups among the authors of international agricultural trade. This is evidenced by my analysis that of the 301 authors, only 51 were worked alone, while the other researchers were members of 55 different groups. Also, the figures of the graphs and linking analysis presented in the study suggest that there are decisive authors in the network of relationships. These authors stand out for their Degree, Closeness Centrality, Betweenness Centrality, and PageRank. They play a decisive role as members of their group and in the entire network of relationships. My study confirms that the players who are members of the groups have a competitive advantage over the individual actors.

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ANALYSIS OF THE IMPLEMENTATION OF BLOCKCHAIN-BASED FOOD TRACEABILITY SYSTEMS

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Abstract: *Nowadays, consumers are increasingly concerned about the safety and origin of food. In recent years, food scandals, sometimes over-reacted by the press, have fundamentally shaken consumer confidence in food available in stores. In order to be able to deal with emergencies more effectively and to increase consumer confidence in products, more up-to-date solutions and measures should be introduced. In most modern traceability systems block-chain technology is used for data storage and sharing. It enables users to track the path of products in real time through the decentralized system provided by a blockchain. This technology complements the current barcode and RFID-based product tracking solutions that bring fundamental changes to food supply chains, but many companies are deliberately resisting system deployment, partly due to excessive cost burdens. In our study, we are looking for the answer to the conditions that can be effectively applied by this decentralized database technology, what are the benefits of its introduction, and the challenges facing food companies that support technology. We analyzed the two most widely used solutions by IBM and a Hungarian-based company and comparing the "traditional" food traceability systems. As a result, our goal is to develop a recommendation system that will enable food businesses to get a clearer picture about the use of blockchain technology and can decide whether such a development project can be rewarded for them.*

Keywords: *Food traceability, Blockchain, Food safety.*

1. Introduction

Scandals related to food safety and the origin of food products sometimes overreacted by the media have shaken the confidence of customers in commercial food products in recent years (Lakner, Szabó and Hajdúné 2005). To some extent, as a consequence of this, new principles have been laid down in EU food regulations, where consumer health protection has become one of the essential principles.

At present, the majority of food products are produced on a large scale, and due to globalization, they reach a large number of consumers fast. Production, distribution and foodstuffs trade represent exceptionally complex business activities. Therefore the development of new procedures and methodologies are needed to safeguard food quality. However, as consumers have no overview of the circumstances of food production and applied technologies, confidence in manufacturers may provide indications in the selection of a specific product. Today, emphasis

will be put on the issue of food safety in all sectors of the food industry (Ding, et al., 2017). In an attempt to deal with emergency situations more efficiently and to promote consumer confidence in the credibility of products, these risk factors have resulted in the formulation of stricter regulations and measures. (Cebeci, Guney and Alemdar 2008). Problems that can arise might be solved by compliance with the legislation (or by their enforcement) in this field, by the introduction of quality management systems, the traceability, and identifiability of products beyond a reasonable doubt. Therefore the existence or lack of food safety have become significant obstacles restricting global trade (Golan, Krissof and Kuchler 2004).

More and more consumers want to know where the purchased meat, eggs or milk came from. With changing consumer habits and a more conscious attitude, there is a growing demand for quality products. An effective solution for this is the blockchain transparent tracking, which also provides many benefits for livestock farmers. The

essence of Blockchain or block-chain technology is that a distributed database records a list of continuously growing data blocks. The system is designed to prevent data from being altered and tampered with.

Blockchain is an emergent technology concept that enables the decentralized and immutable storage of verified data. Over the last few years, it has increasingly attracted the attention of different industries (Hackius and Petersen, 2017). One major promise of blockchain is to create transparency – every member of the network has access to the same data, providing a single point of truth (Tapscott and Tapscott 2016). Supply chain transparency is one of the most important and hardest to achieve improvement areas for logistics and SCM (Abeyratne and Monfared 2016). The information stored in the blockchain exists as a shared - and continuously matched - database. The blockchain is not stored in a single location,

which means that the registry is truly public and easy to authenticate. There is no centralized version of the information that a hacker could corrupt. It is stored on millions of computers at once and anyone can access the data over the Internet. Blockchain-based tracking ensures that data is recorded independently of the actors and cannot be changed.

With blockchain-based tracking, after a QR code is read, the product can be determined from which entity it comes from, and what storage and processing processes it has undergone. Of note, blockchain provides not only benefits but also has challenges attached to it (Petersen et al., 2016; Yli-Huumo et al., 2016; Xu, 2016). Most result from the early maturity phase of the technology. While these challenges (e.g., limited throughput) have to be addressed from a technological perspective, they should not distract possible users from evaluating the benefits of the underlying principles.
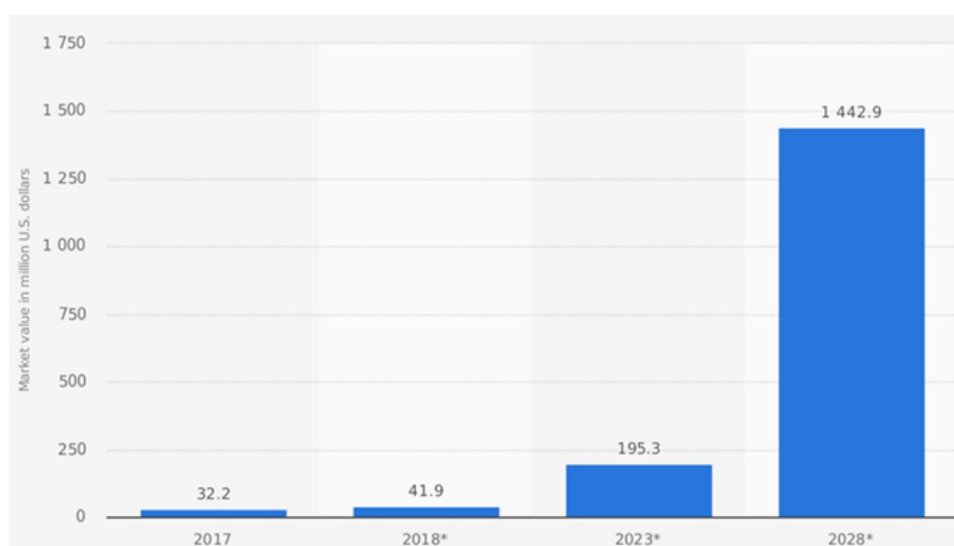

Fig. 1. *Forecasted value of blockchain in the agriculture and food market worldwide form 2017 to 2028 (in million U.S. dollars) (Source: BIS Research, 2018)*

The global blockchain in agriculture and food supply chain market was valued at USD 41.2 million in 2017 and is projected to reach USD 429.7 million by 2023, at a CAGR of 47.8% during the forecast period. The blockchain in agriculture and food supply chain market is estimated to be valued at USD 60.8 million in 2018 and is projected to reach USD 429.7 million by 2023, at a CAGR of 47.8%. Blockchain technology is revolutionizing the food and agriculture sectors by enhancing the decision-making capabilities of organizations. It finds several potential applications in these sectors,

some of which have already been explored. The major applications of blockchain technology in food and agriculture include traceability and tracking, payment and settlement, smart contract, and governance, risk, and compliance management. The growth of the blockchain in agriculture and food supply chain market is attributed to the increase in demand for supply chain transparency, the rise in cases of food fraud, and growth in concerns toward food wastage (BIS Research, 2018).

The remainder of the paper is structured as follows: First, we summarize the basic features of

traceability and blockchain technology. Then, we introduce two use case exemplars explored in theory and practice. Subsequently, we present the findings of a Hungarian survey we conducted within the food industry to look into the prospects of the four use cases and expectations and apprehensions towards blockchain. We conclude by discussing the findings and daring a prognosis on the future of blockchain in the food industry.

2. Materials and Methods

Compound annual growth rate (used in the introduction) is the rate of return that would be required for an investment to grow from its beginning balance to its ending balance, assuming the profits were reinvested at the end of each year of the investment's lifespan. The compound annual growth rate isn't a true return rate, but rather a representational figure. It is essentially a number that describes the rate at which an investment would have grown if it had grown the same rate every year and the profits were reinvested at the end of each year. In reality, this sort of performance is unlikely. However, CAGR can be used to smooth returns so that they may be more easily understood when compared to alternative investments. The compound annual growth rate can be used to calculate the average growth of a single investment (Investopedia, 2018).

To answer the questions, we used two sets of questionnaire data where the results were evaluated separately. However, they were used in one study and proved to be particularly useful for drawing conclusions relevant to our subject. The first survey on the shopping habits of Hungarian consumers was carried out in 2016. This representative survey examined the information-gathering habits of Hungarian customers regarding food products. It was followed by another online questionnaire from 1 June to 15 July 2017, which investigated the relationship between young (most likely under 40) Hungarian consumers representing massive customer demand (80% of respondents came out of this age group) and product traceability information beyond legislative requirements.
One of the most common objectives of the research is the segmentation of consumers or respondents, i.e. the formulation of groups that are relatively homogeneous, but at the same time well distinguishable from each other (heterogeneous). Group formation or clustering is

an area of crucial significance in statistical methodology and a priority issue in practical applications as well (Simon, 2006). Segmentation was carried out by cluster analysis, a multivariable statistical method often used in scientific research and practical applications, which summarises the methodology of clustering, i.e. group formation. (Simon, 2006). As cluster analysis is highly sensitive to outliers, as a first step, a simple chain method was applied to explore them and to eliminate them by the SPSS program. We evaluated the two variables involved in the investigation by the same scale, so standardization was not required. As the number of groups to be formed was not predictable, the hierarchical architecture and in particular, the aggregate method (Ward's method, which aggregates those clusters, where the increase of the internal variance will be minimal) were chosen.

3. Results

Above all, we present two implementations of the use of the blockchain in the food industry. TE-FOOD focuses on food security in emerging economies and the supply chain from the farm to the dining table. According to their website, the company is present on the Hungarian, Vietnamese and South African markets, with 6,000 market participants and 12,000 pigs, 200,000 poultry and 2.5 million eggs on their network. With the help of a fully transparent tracking system, quality or food safety hazards can be accurately marked and localized throughout the food supply chain. With this system, the number of food-related abuse can be reduced and can increase the health of the population in the affected areas proportionally, and the confidence in food from the regions, which in the long run can also contribute to the development of local markets and the rise of the population. The system has three major elements: Fresh Food Traceability, Animal Livestock, Antibiotic traceability.

Fresh Food Traceability: To track primary products and fresh produce from farm to table (currently: pork, cattle, chicken, eggs, fish) The TE-FOOD system provides a complete solution in all areas of the supply chain, its logistics steps, and food safety tasks. With cost-effective identification tools and software solutions, it makes the process of producing the product transparent to the actors.

Animal Livestock: Monitoring of livestock stock on farms with the epidemiological subsystem. (Pork, Cattle, Chicken, Eggs, Fish) The TE-FOOD Livestock Module is capable of managing livestock in entire regions or countries.

It tracks the changes in files that can predict the rate and probable direction of an epidemic from the data with the built-in prediction sub-system.

Antibiotic traceability: Monitoring of antibiotics and vaccines used in animal husbandry (pigs, cattle, chickens, eggs) In addition to the farm management system for TE-FOOD, a sub-module for animal vaccination records is being installed in which animal antibiotic treatments can be recorded. This information can now be shared, thereby reducing costs, among other things, by avoiding multiple vaccinations.

The other widely used system is IBM Food Trust, which also uses blockchain technology to create unprecedented visibility and accountability in the food supply. Blockchain technology stores digitized records are decentralized and unchangeable, promoting trust and transparency, which will help food providers get better providing the food system and safer food.

The IBM Food Trust system is also modular: Trace module, Certifications module, and Data Entry and Access module. The Trace module helps support food tracking. Using it, participants can track the status and location of food in any direction along the supply chain. With the Certificates module, you can safely manage an organization's food-related documents and provide access to authorized certificates from other network members. The Data Entry and Access module address the storage and management of transaction data.

It can be seen that the two solutions have a slightly different approach, TE-FOOD is more specialized while IBM is working on a more general approach. But after examining the two systems, we can find that the most important elements of food traceability can be solved with their use:

1.The problem of obsolete records. Even today, food records are often hand-guided due to different standards and fragmentation of data.

2.Lack of transparency. Slow and inefficient product recall involves significant economic and health risks.

3.Not an efficient transaction system. Food chains are characterized by faulty and often delayed payment systems. A further problem is

limited access to broad markets, which means that food producers have to pay a significant brokerage fee.

The tracing of food products has three motivating factors. Food production companies are encouraged to comply with domestic and European Union legislation, supplier requirements systems, commercial (eg IFS, BRC) quality management systems and effective product recall (with minimal cost) to implement agile tracking. In our research, we sought to find out whether it would be worthwhile to operate a system (such as a blockchain based traceability system) that provides additional information besides these factors. In our case studies, companies said they would be able to invest in such projects due to the low number of recall calls if consumers were to finance the extra costs.

At the beginning of our research, we examined where consumers get their information about food. It was necessary to assess the effectiveness of initiatives that are currently seeking to share traceability data with customers. It is obvious, that consumers are most interested in price and ingredients. The latter is due to the fact that today the proportion of "conscious" customers is increasing and the proportion of people suffering from food allergies and intolerance is increasing.

The result shows that the sources from which traceability data could be obtained are insignificant. It can be stated that for a relatively small number of products have an identifier that can provide additional information so that consumers can rarely get information through such channels. Of course, the demand for extra information is highly dependent on the type of food product, it would be a mistake to treat all product lines and their complexity at the same time.

In our survey, we asked how important it is for consumers to be able to trace the production and processing conditions of the food purchased. Spearman's rank correlation calculation showed that there is a significant relationship ($p < 0.05$) between requesting follow-up data and health awareness and monthly income levels. It should also be noted that there is also a strong correlation between the two explanatory variables, ie those with higher incomes are spending more on health-conscious eating.

After that, consumers were classified into homogeneous groups based on two relevant variables. The two variables were the need for

health awareness and traceability data for food products (as we have seen, there is no difference between the different food product groups in this regard). As a result of the study, three clusters were obtained. The first group consists of 'neutral' consumers, the second is those for whom traceability data is important, but they are not considered to be health conscious and the third group is those for whom both factors are particularly important. Based on the results, the majority of consumers can be classified in the first cluster. As the next step in our research, we were curious as to how consumers think about products that have tracking data that provide

extra-legislative information, and whether extra traceability affects the price and quality of the product. The results show that consumers think that food traceability affects quality as well as food safety. Therefore, in their opinion, products with such data are more expensive than "traditional" products. We can see that most consumers do not surprisingly would buy products with extra traceability data at the same price as traditional products. In fact, the interesting thing is that the remaining few percents would decide otherwise, as no problem would come from the extra information.

Table 1. *The proportion of customers purchasing products containing data beyond legislative requirements.*

	Peking	Xianyang	Hungary
At the same price as traditional products	93%	97%	89%
At a price higher than that of traditional products	55%	50%	64%
Rate of acceptable extra charge	11%	11%	1-10%

Source: Zhao et al. 2010 and authors' survey, 2017

However, at a price higher than traditional products, only more than half of the customers would choose products that can be traced to them. According to the survey, the rate is higher in Hungary (64%). By contrast, the acceptable margin is lower, and the vast majority of solvent buyers would only accept a value of between 1% and 10%. According to our studies, there is a clear correlation between the need for extra traceability data for both health awareness and household income ($p < 0.05$).

On this basis, it can be concluded that there is considerable doubt as to whether the development, design, and operation of the blockchain based traceability system mentioned in the introduction can be economically feasible at such a premium. It would be a further condition for consumers to request and pay for this data on a long-term and regular basis, but according to our survey, even a smaller proportion of respondents would be willing to do so.

Conclusions

In our research, we were looking for an answer to the conditions for operating a blockchain based system that provides additional information.

However, the implementation of these information services is doubtful in several ways. In our case studies, companies said they would be able to invest in such projects due to the low number of recall calls if consumers were to finance the extra costs. Firstly, several studies have shown that consumers are mostly unaware that product tracking is mandatory in all cases, but their perception is limited to the product chain. Therefore, product tracking is often identified with food safety.

Furthermore, a high proportion of consumers doubts the reliability of the information provided, and it would be an important condition to continuously and regularly request these data. However, there is little chance that the average consumer will query the data for the same product type permanently.

It is also questionable whether an acceptable surcharge is to be interpreted since more than half of the respondents would not consider the resulting price increase to be acceptable at all. Developing, building and operating a complex blockchain based information system that provides customer-friendly data requires a major investment that is not or hardly feasible from a

10% premium considered acceptable by customers.

Our research shows that the trademark or trust placed in the manufacturer is more important than the accurate and continuous availability of tracking data.

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INHIBITION EFFECT OF LAB
AGAINST *STAPHILOCOCCUS AUREUS* IN DAIRY PRODUCTS

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Abstract: *S. aureus is a pathogenic microorganism and represents a threat to human health worldwide. Milk and dairy products are a favorable environment for the development of many bacterial species, the dominant being the lactic acid bacteria (LAB). S. aureus bacteria often contaminate these products and cause poisoning and other serious illness.*

Researches of the last decades have focused on the interactions between S. aureus and LAB, due to their ability to inhibit the development of other species through biosynthesized compounds in fermented products. In this perspective, this study aimed to evaluate the inhibitory potential of some species of LAB used in the food industry (Lb. delbrueckii subsp. bulgaricus, L. lactis subsp. lactis, and S. thermophilus) on the pathogenic germs of S. aureus. The results obtained underlines the antipathogenic properties of LAB and the perspective of using them as a biocontrol method in dairy products.

Keywords: *lactic acid bacteria, inhibition, dairy, interaction, s. aureus*

1. Introduction

Lactic acid bacteria (LAB) have been used in food fermentation for many centuries and play an important role in the food industry, as they contribute to the aroma, texture and nutritional values of the food.

Interest in new methods of biological preservation has increased in recent years, supported by research showing that antagonistic microorganisms and their antimicrobial metabolites may have some potential use as biopreservation elements, a way to control growth and to inactivate unwanted micro-organisms. from food. Biopreservation using lactic acid bacteria and/or their metabolites is an alternative for improving food safety. These properties of lactic acid bacteria determine competition for nutrients and the production of one or more active antimicrobial metabolites. (Topisirovic et al., 2006).

Lactic acid bacteria holds an important role in the production of antipathogenic substances in fermented dairy products and form the predominant culture in their microflora. As a result of lactic fermentation, certain metabolites are produced, such as lactic acid, acetic acid, diacetyl, ethyl alcohol, acetaldehyde, carbon dioxide, bacteriocins. Each of these compounds, from the beginning of fermentation to the time of final product consumption, provides an additional obstacle for pathogens; considering the fact that there is a specific spectrum of inhibitory substances, it turns out that the antimicrobial potential of LAB present in dairy products is defined by the conjugated action of these substances, often synergistic. Due to these antipathogenic effects, LAB are considered safe, non-toxic microorganisms, beneficial to health (Ghanbari et al., 2013).

In this context, one of the trends in the global food industry is to eliminate the use of chemicals

and synthetic additives, simultaneously with increasing interest in food biopreservation. The requirements for minimally processed, fresher foods, functional and nutritional foods could be met, at least in part, by the complex use of LAB and their active substances synthesized.

Food poisoning with *S. aureus* is one of the most common transmissible diseases worldwide. This intoxication results from the ingestion of foods (especially milk and dairy products) that contain one or more preformed staphylococcal (some thermoresistant) enterotoxins. Of the staphylococcal species, *S. aureus* is the most important species and can cause numerous infections with various effects (from superficial damage, to septicemia and death). Inhibition of *S. aureus* by lactic acid bacteria has been studied in numerous experiments worldwide. Refrigeration at temperatures above 10 °C and low yield of dairy cultures starter during lactic fermentation are the main factors involved in staphylococcal intoxication outbreaks. Due to the frequency and virulence of this pathogen, there is an increased interest in bacterial interactions analysis and understanding the inhibition mechanisms determined by LAB. (Charlier et al., 2009).

The aim of this study is to evaluate *in vivo* the inhibition degree of *S. aureus* germs caused by LAB, commonly used in bacterial starter cultures of fermented dairy products (*L. lactis* subsp. *lactis*, *Lb. delbrueckii* subsp. *bulgaricus* and S. *thermophilus*).

2. Materials and Methods

To assess the degree of inhibition caused by LAB on the development of pathogenic germs werw used *S. aureus* (ATCC 25923), *Lactococcus lactis* subsp. *lactis, Lactobacillus delbrueckii* subsp. *bulgaricus* and *Streptococcus thermophilus* strains with 10^5 cfu/g initial concentration. The samples of dairy products were obtained from local producers and used as follows: pasteurized cow's milk (1.5% fat) - for *Lb. delbrueckii* subsp. *bulgaricus*; natural yogurt, from cow's milk (3% fat) - for *S. thermophilus*; fresh cow cheese (0.5% fat) – for *L. lactis* subsp. *lactis*.

In the experiments, three concentrations of lactic acid bacteria 10^3, 10^4 respectively 10^5 - ufc/g (ml) and a single concentration of *S. aureus*, kept constant – 10^2 ufc/g (ml) were applied. From each product, 10 samples were taken, for each concentration of LAB. The inhibition of pathogenic germs was pursued in three stages: after 24h (T1) incubation at 37 °C, 48h (T2) incubation/37°C, and after 72h (T3) / 37°C incubation.

For each concentration level was transferred into a sterile tube 1 ml - LAB and 1 ml - pathogenic germs, making a mixture for all inoculated concentrations in the analyzed samples. Each sample was prepared for analysis and 1 ml of the mixture of LAB and pathogenic germs was added. The inoculation was performed in Petri dishes, on the Baird-Parker selective media, which were subsequently incubated; the results obtained after 24h, 48h and 72h were interpreted.

The working methods were in accordance with the current national and international standards,and the culture media used were in accordance with the working method.

3. Results and Discussion

In the first stage, all the samples of dairy products were analyzed to determine the presence or absence of pathogenic germs. The results were negative, the samples were not infested with *S. aureus*. From the determination of the pH of the samples the following results were obtained: for pasteurized milk - 6.6, for yogurt - 4.4 and for fresh cheese – 4,45.

Lb. delbrueckii subsp. *bulgaricus* - *S. aureus* interaction

The first set of tests targeted the bacterio-static/microbicidal effect on *S. aureus* pathogenic germs.

The concentrations of lactic acid acid bacteria inoculated in the analyzed samples were: $C_1 - 9,1$ x 10^3, $C_2 - 8,2$ x 10^4 and $C_3 - 7,2$ x 10^5 (ufc/ml), and the concentration of *S. aureus* was constant, $C_0 - 9,6$ x 10^2 ufc/ ml. Each sample of pasteurized milk was inoculated with 1 ml of mixture: LAB (concentration C_1, C_2 and C_3 respectively) + *S. aureus* (concentration C_0). The results obtained after incubation (24h, 48h and 72h respectively) are shown in Fig. 1.

From the graphical representation (Fig.1.) it can be observed that at the C_1 concentration the inhibition effect for *S. aureus* germs is visible, but does not affect the staphylococcus concentration (there was a progressive reduction, up to 80.5%, after 72h of incubation). From C_2 concentration, a strong inhibition of pathogenic germs is observed, starting with the first incubation period; after 24h, a reduction of 1.37 log cfu/ml is observed which continues to 1.94

log cfu / ml (98%) after 72h, when total inhibition was observed in two samples (20%). At maximum concentration the inhibitory effect is much more pronounced reaching levels of 1.5 log, 1.87 log respectively 2.5 log (corresponding

to the three incubation periods). In this case, the total inhibition of *S. aureus* germs was observed in 20% of the samples, after 48h and in 70% of the samples after 72h.
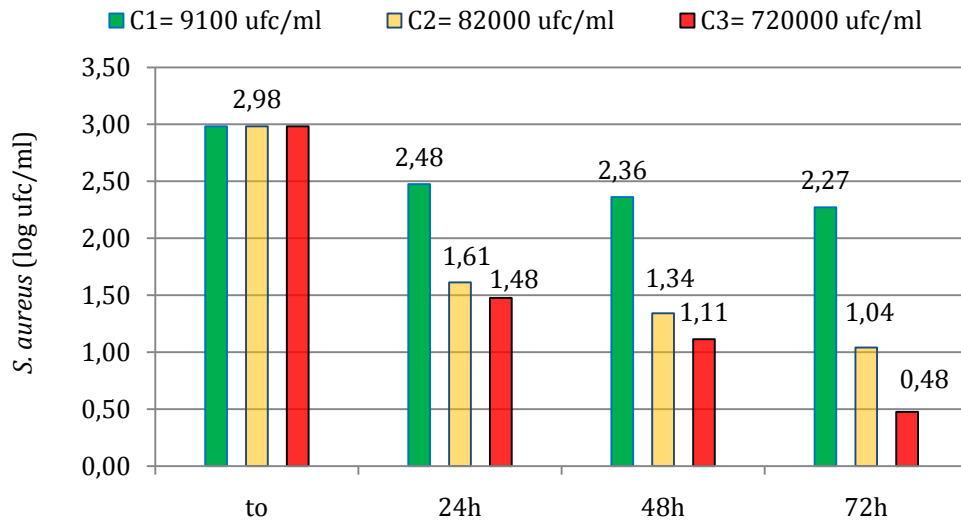

Fig.1. *Inhibition level of S. aureus relative to C_i concentration of Lb. delbrueckii subsp. bulgaricus*

S. thermophilus - S. aureus interaction

The experiment followed the antimicrobial capacity of *S. thermophilus* in relation to the same pathogenic germs. The working procedure was similar to the previous case; the concentrations of lactic acid bacteria inoculated

in the analyzed samples were: C_1 - 8.7×10^3, C_2 - 9.0×10^4 and C_3 - 8.6×10^5 (ufc / g), and the concentration of *S. aureus* was constant, C_0 - 8.8×10^3 ufc / g. The graph in Fig. 2. includes the results obtained in this case.
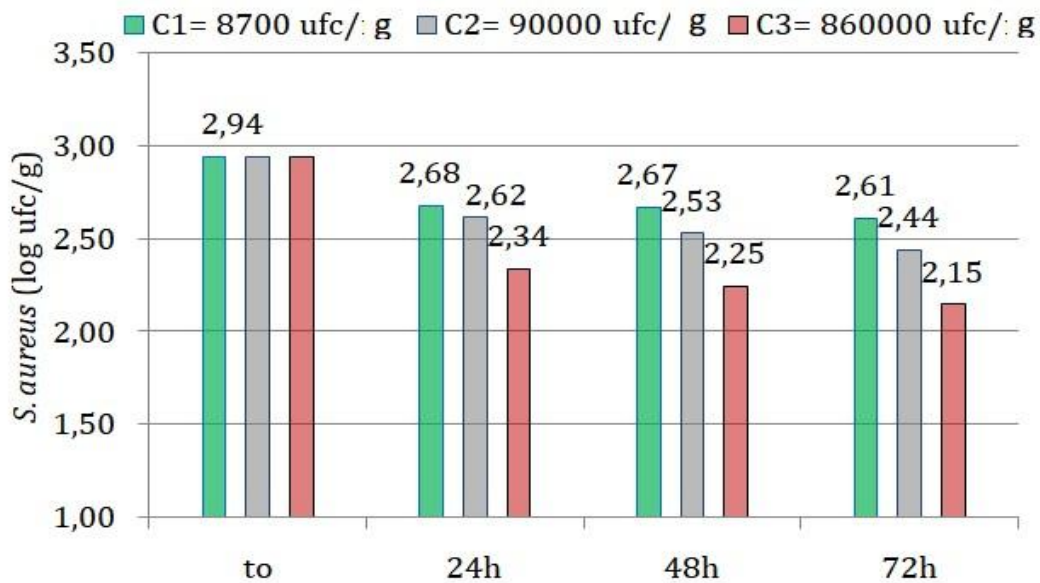

Fig. 2. *Inhibition level of S. aureus bacteria relative to C_i concentration of S. thermophilus*

From Fig. 2. results in a much weaker influence of *S. thermophilus* (in natural yogurt) on the *S. aureus* germs, without modifying their concentration, in most samples (99.97%). After each of the three incubation periods, the inhibition degree of pathogenic bacteria increased correlated with the concentration of LAB, reaching limit values of 0.6 log ufc/g (after 24h), 0.69 log ufc/g (after 48h) and 0.79 log ufc/g (after 72h).

L. lactis subsp. *lactis* - *S. aureus* interaction

Similar to previous experiments, the influence of *L. lactis* on the pathogenic microorganisms chosen as an indicator was tested, using as an interaction medium the fresh cow cheese.

The sets of 10 samples were inoculated with the same concentrations of LAB, exactly $C_1 – 8,0$ x 10^3, $C_2 – 7,5$ x 10^4 şi $C_3 – 7,2$ x 10^5 (ufc/g) and the concentration of *S. aureus* was $C_0 - 9.3$ x 10^2 ufc/g. The results are shown in Fig. 3.
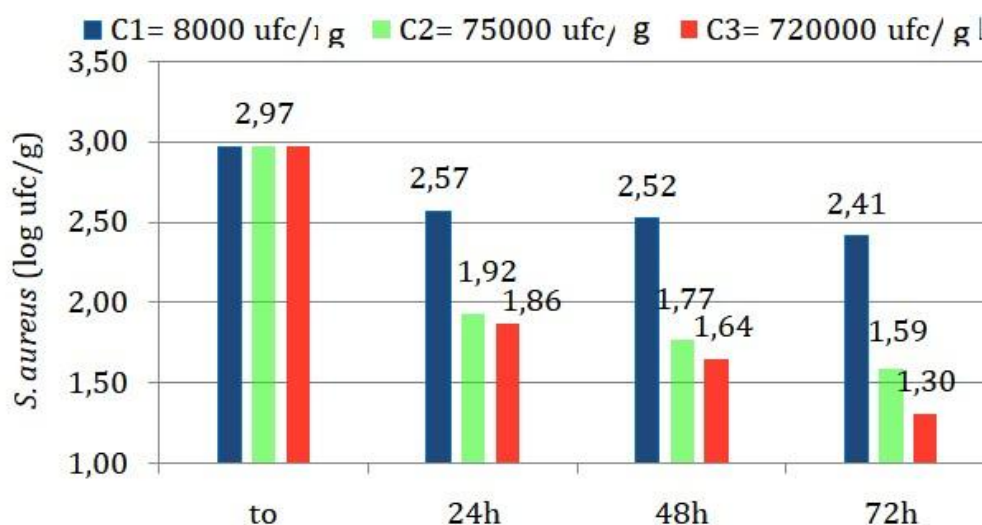

Fig. 3. *Inhibition level of S. aureus bacteria relative to C_i concentration of L. lactis*

In Fig. 3. we observe an important bacteriostatic action from the C_2 concentration of LAB. At the minimum concentration, there was a decrease in the number of pathogenic colonies by 0.56 log ufc/g, after 72h. Although the effect of total inhibition was not observed, from the C_3 concentration the degree of inhibition was considerable, over 90% after 24h, reaching a maximum value of 1.67 log ufc /g (97%) after 72h of incubation.

Conclusions

The results obtained in all three experiments reflect a significant inhibition action of pathogenic microorganisms (*S. aureus*) by LAB inoculated, in direct correlation with the incubation time and their initial concentration.

The best results were obtained in the case of *Lb. delbrueckii* subsp. *bulgaricus* and *L. lactis* subsp. *lactis*, while *S. thermophilus* determined the lowest inhibition values. The antimicrobial properties obviously in these experiments are probably due to the cumulative effects of the compounds biosynthesized by these strains: lactic acid, acetic acid, phenyl-lactic acid, bacteriocins, hydrogen peroxide etc.

Valorisation of the antimicrobial potential of lactic acid bacteria is a viable alternative to classic, nutritionally destructive, food preservation methods.

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DESIGN OF SILOS TO CONTROL MOULD GROWTH

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Abstract: Important volumes of cereals are affected worldwide by mould during post harvesting process. The paper is studying the main directions for preventing mould growth in cereal silo, starting from the drying process of grains, preservation of a proper dried cereals being the safest method for reducing the risk of mycotoxins. Starting from the analyses of silo construction and the thermodynamic changes of air-grains system during silo aeration, it is proposed a decision management system for a safer storage of cereals. The algorithm is controlling the low speed fans (for cooling stage, when cereals humidity is low), high speed fans (for drying, when cereals humidity has medium value), and a heater (for drying, when cereals humidity has higher value). Decisions are taken based on the input data: type of seeds, temperature and humidity of seeds, temperature and humidity of the cooling/drying ambient air. Two key phenomenon have to be avoided: „dew point" during aeration because of the air cooling and grain humidification because the surpass of equilibrium moisture. The decision system can be implemented on the existing silos, by adding or modifying the automation equipment.

Keywords: mycotoxins, cereals, aeration management

1. Introduction

Mycotoxins are varied types of fungal composite, with baneful effects on human and animal health. Due to the presence of mycotoxins in different grains, fruits, etc, the safety of food stuff is affected. The same case applies to feeds that can be contaminated and can affect animal health and well being. The most well known mycotoxins that concern human health are from secondary metabolism of *Claviceps, Aspergillus, Penicillium, Fusarium* and *Alternaria* [3,5] A specific concern is related to mycotoxins from cereal grains due to the confirmed or potential relevance in human health (see Table 1).

Mycotoxin species varies depending on the geographical area, climate conditions reflecting specific environmental requirements for growth and secondary metabolism. Mycotoxins like *A. flavus, A. parasiticus* and *A. ochraceus* favor warm and humid conditions, despite *Penicillium expansum* and *P. Verrucosum*, which are more temperate fungi [5]. According to numerous scientific studies, important volumes of cereals are affected by mould during post harvesting process. Modern preservation of cereals require high silo capacity where grains physical parameters are monitored and the cereal mass is ventilated if certain condition occur [1,8].

Table 1. *Main mycotoxins of confirmed or potential relevance in human health [5,4]*

Mycotoxins	Fungal species	Foods
Ergot alkaloids	*Claviceps purpurea*	Cereal grains
Aflatoxins	*Aspergillus flavus; A. parasiticus*	Nuts; maize kernels; dried fruits
Cyclopiazonic acid	*A. flavus*	Nuts
Ochratoxin A	*A. ochraceus; Penicillium viridicatum; P. cyclopium*	Cereal grains and products; pig products; raw coffee
Citrinin	*P. citrinum; P. expansum*	Cereal grains
Patulin	*P. expansum*	Apple products
Citreoviridin	*P. citreo-viride*	Rice

T-2 toxin (type A trichothecene)	*Fusarium sporotrichioides; F. poae*	Cereal grains
Diacetoxyscirpenol (type A trichothecene)	*F. sporotrichioides; F. poae*	Cereal grains
Deoxynivalenol (type B trichothecene)	*F. culmorum; F. graminearum*	Cereal grains
Zearalenone	*F. culmorum; F. graminearum; F. sporotrichioides*	Cereal grains
Fumonisins; moniliformin; fusaric acid	*F. moniliforme*	Maize kernels
Tenuazonic acid; alternariol; alternariol methyl ether; altenuene	*Alternaria alternata*	Fruit; vegetables; cereal grains

The effect of temperature and moisture inside silo is complex, depending on also the type of grains, mould and pest risk increasing with the temperature and moisture (Fig. 1) [2,9].

2. Proper drying, first condition for mould growth prevention

The first essential condition for long-term storage of cereals is the reduction of moisture to values below 14% depending on the type of cereals. Typical values of the drying air temperature in the case of constant temperature drying [6,10] that has its limitation, because the grain pericarp becomes impermeable to the water vapours, therefore is recommended that the air temperature to be adjusted every moment upon the grains humidity, like in table 2, where, T - temperature of the drying agent, [°C]; τ - duration of the process, [min.]; U - humidity of the product, [%]; [6,11].
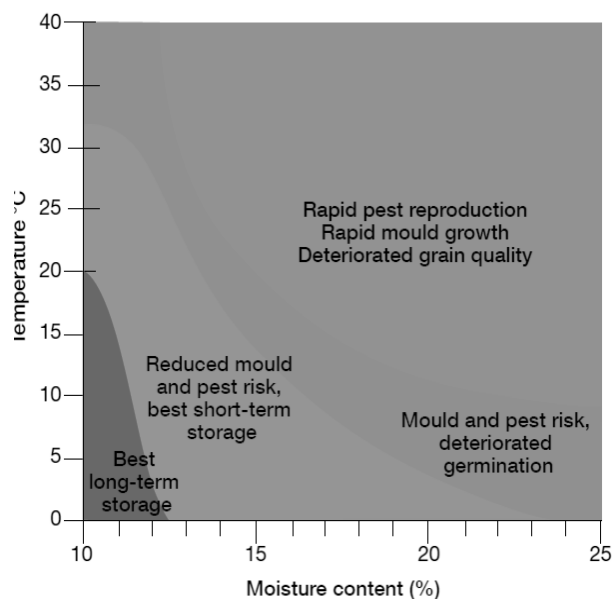

Fig. 1. *Effects of temperature and moisture on stored grain [17]*

Table 2. *Comparison of the equations T (τ, U), depending on the seed destination [6]*

Biological material	Equations T (τ, U), depending on the seed destination	
	Germination	*Consumption*
Wheat	T(τ, U)=192-75 log U-24 log τ	T(τ, U)=239-50 log U-56 log τ
Corn	T(τ, U)=216-73 log U-25 log τ	T(τ, U)=216-64 log U-22 log τ
Rye	T(τ, U)=189-28 log U-45 log τ	T(τ, U)=263-54 log U-50 log τ
Soy	T(τ, U)=186-82 log U-11 log τ	T(τ, U)=191-61 log U-17 log τ
Sunflower	T(τ, U)=164-39 log U-39 log τ	T(τ, U)=183-40 log U-42 log τ

3. Construction and thermodynamics of grain silos

Long-term storage of cereals is carried out in special silos (Figure 2). Typical construction consist of the following components: 1 – air output; 2- cereals input; 3 – silo roof; 4- silo walls; 5- fan; 6 – air duct; 7- silo foundation; 8- circular concrete distribution system; 9 – floor support; 10 - perforated floor.

During preservation, biochemical processes lead to increase humidity and temperature of the grain mass, which is why periodic aeration intervention is required. Aeration of stored grain has four main purposes — **preventing mould, inhibiting insect development, maintaining seed viability and reducing grain moisture**.

Cereals are good thermal insulator and without aeration, it will maintain its heat for a long time. Without movement, the air surrounding the cereals will reach the moisture and temperature equilibrium within a few days.

During aeration process, moisture from the grain should be transferred to the ambient air. The ambient air should have a lower relative humidity in order to obtain a high percentage in the moisture transfer process. These percentages differ, depending on the type of grain, each having a balance between cereal humidity and relative humidity of the air. When this balance point is reached, no more moisture transfer takes place. In Table 3, are shown examples of humidity equilibrium, depending on the relative humidity of air, at 20°C
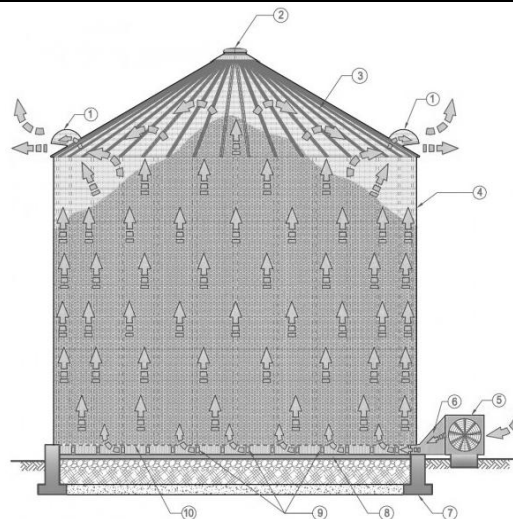

Fig. 2. *Typical grain silo diagram* [19]
.

Table 3. *Equilibrium moisture, [%], depending on the relative humidity of the air, at 20°C [6]*

Species	Air Relative Humidity,%				
	20	30	50	70	90
Wheat	7,8	9,2	11,8	14,3	19,9
Rye	8,3	9,5	12,2	15,2	20,8
Barley	8,3	9,5	12,0	15,2	20,9
Corn	8,2	9,4	11,9	14,9	19,2
Sunflower	-	-	5,9	7,8	11,4
Soy	-	-	6,4	8,1	12,8

4. Cooling or drying

The systems used for grain aeration are designed to perform 2 types of processes: aeration cooling and aeration drying. Aeration cooling can be achieved with low airflow rates of 2–3 liters per second per tone.

Aeration drying can be achieved with fans delivering 15–25L/s/t (see Figure 3). During aeration drying, the ambient air can be warmed supplementary, using a heater or by mixing it with combustion gas.

Depending on the grain moisture, 3 types of **aeration action** can be started (Table 4):
- Grain that is dry enough to meet specifications for sale (12%..14% humidity). The grain can be **cooled**, without drying, to slow insect development and maintain quality during storage.
- Grain of moderate moisture (up to 16% for wheat) requires **aeration drying** to reduce the moisture content, to maintain quality during storage. If aeration drying is not available immediately, moderately moistened grains can be cooled for a short period to slow mould and insect development, and then dried when the proper equipment is available. After drying to the

required moisture content, the grain will be cooled to maintain its quality.
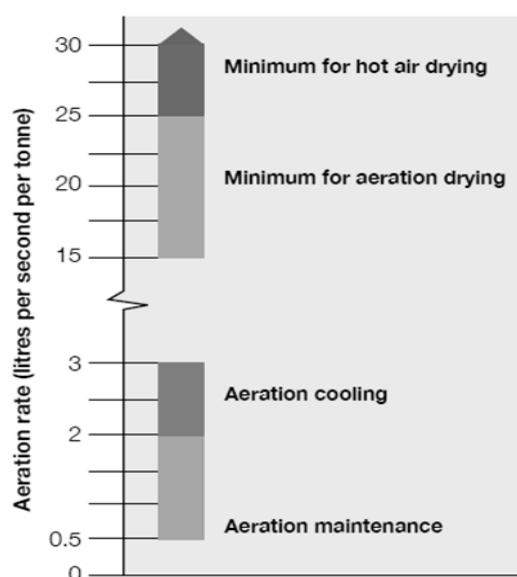

Fig. 3. *Aeration rates for grain drying and cooling [14]*

- High-moisture grain (16% and higher for wheat) will require immediate moisture reduction by drying with warmed air before cooling for maintenance.

5. Problems arising during grain storage

5.1. Moving of moisture front

During aeration, air is forced into the silo from the bottom through a perforated floor and evacuated through the roof vents. The moisture transfer from the grain to air takes place in the drying zone. The front of the drying zone should move until the top of the grain mass within the allowable storage time. The allowable storage time is reduced for high temperature and moisture content, and therefore a higher airflow rate is necessary [18].

5.2. Moisture migration during cold and warm weather

During storage, the moisture in the grain mass is irregular in the silo. Over time, due to changes of temperature because of the weather, can occur zones with high moisture content.

The low outside temperature cools the grain nearer the wall. This results in a downward air flow through the grain and upward towards the centre of the bin. Due to the movement of the air through the grain, it heats up and absorbs the moisture from the grain. When the warm and moist air reach the cold surface of the silo, condensation occurs, leading to grain spoilage. The reverse airflow may occur if grain is still in storage in the late spring. In warm weather, the heated walls of the silo cause the moisturized air flow to move up and into the bin through the centre of the bin. Because of condensation, high values of moisture occur on the bottom of the silo.

Moisture can increase in cases of snow or rain entering the silo through ventilators or roof and wall cracks.

5.3. Grain cooling in winter

Aeration in the cold season brings a number of benefits due to the inexpensive cooling capacity of the grain mass. When relative air humidity during frost periods is also very low, aeration can remove some of the moisture content of the grain. However, it should be taken into consideration that, after cooling with cold air, the cereals behave like a good thermal insulator, with important regions remaining at very low temperatures for long periods of time. Restarting the aeration processes with high moisture content allows the appearance of moisture on the surface

of the cold cereal mass, with effects of intensification of the development of fungi [15].

Aeration management in a grain silo for control mould growth

Taking in consideration the construction of the common grain silo and the limitation of aeration phenomenon, it is proposed an algorithm that can help to avoid mould growth during grain storage [12, 11, 16]

The model is designed to be implemented on classic silo with perforated floor, where aeration is done by using low speed and high speed fan.

The algorithm aims to start the following work regimes:

- cooling using low speed fan for seed humidity that ensure long storage (e.g. less than 14% for wheat);
- drying using high speed fan for medium humidity (e.g. 14-16% for wheat);
- drying with warmed air - using high speed fan, for high humidity (more than 16% for wheat).

The input parameters of the decision-making system (figure 4) are: grain type; grain temperature; grain humidity; air temperature and relative humidity.

Seed temperature values are provided in the form of a set of "n" values corresponding to an "n" number of temperature transducers located inside the silo, at different points in the grain mass. Similarly, the grain moisture is collected in the form of a string of "m" values provided by moisture sensors in the grain mass. For specific purposes, the model needs to calculate the following values: t_{gmin} = minimum grain temperature, [ºC]; t_{gmax} = maximum grain temperature,[ºC]; t_{gmed} = medium grain temperature, [ºC]; u_{gmed}= medium grain humidity, [%].

The algorithm is following the next steps:

1. Before starting the fans, first should be checked the possibility of the dew point occurring during to ventilation of air through the grain mass, as follows:

- on the basis of the ambient air temperature and humidity values, first is determined the point A in the Mollier diagram (at the intersection of ambient air temperature and relative humidity); assuming that the moisture content of the ventilated air is constant, the point B is determined by descending from point A vertically to the temperature corresponding to the lowest value measured by the cereal mass temperature sensors. If the intersection point is

under the saturation curve φ=100%, the fans are switched off, because of condensation risk.

2. If the point B is over the saturation curve, should be checked the maximum values of the grain temperature; if t_{gmax} > 25 [ºC] (typical value, but can be set different), the aeration can start. If the t_{gmax} < 25[ºC], the fans are stopped. Before starting the aeration, the grain humidity should be checked in order to decide which type of aeration will occurs. If u_{gmed}<14% , the grains are dried enough so it is necessary only an **aeration cooling** for reducing grain temperature. If 14%<u_{gmed}16%, the algorithm first calculates the equilibrium humidity, taking in consideration the type of grain and its temperature. If this point

B' is situated over the equilibrium humidity, the high speed fan can be started in the **aeration drying** regime. Otherwise, if the point B' is situated under the equilibrium humidity, the low speed fan will start in order to reduce the grain temperature. In the near future, when the climatic conditions allow, the aeration drying procedure should restart in order to reduce humidity in the grain mass.

 If u_{gmed}>16%, the grain needs urgent drying and can be done with warm air, so the high speed fan and the heater should start.

The values 14%, 16% for u_{gmed} are typical for wheat, but can be set depending on grain type and specific needs).
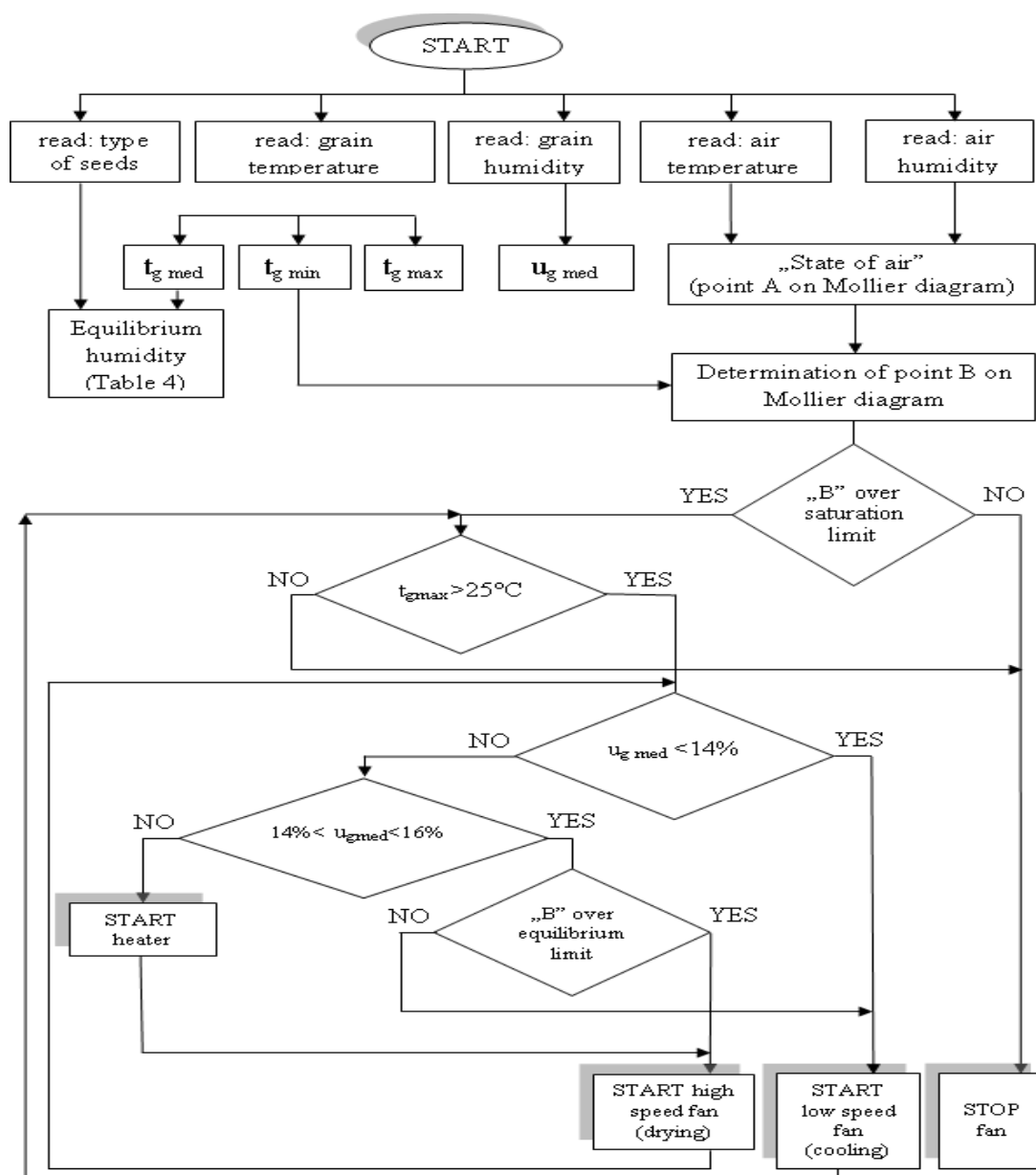

Fig. 4. Algorithm for aeration management in grain silo

Conclusions

Mould growth in grain silos is an important issue due to the mycotoxins baneful effects on the human health. Because of grain hygroscopicity and its thermal insulation properties, silos aeration should be conducted in a proper way, in order to avoid cereal humidity increasing and condensation on the seeds surface.

The paper proposes an algorithm that take in consideration thermodynamic parameters of the grain and ambient air and decide the opportunity of starting aeration cooling, aeration drying or warm air drying. The model proposed is intended to be included in the existing silos automation system with minimum intervention.

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COCKTAILS WITH BEE PRODUCTS PROCESSED IN FUNCTIONAL PRODUCTS

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Abstract: The aim of the present study was to evaluate of the nutritional and senzorial characteristics of mixtures constitute from honey with bee products (pollen, propolis, royal jelly, bee bread).
The sensory analysis method used to test the obtained products were the acceptance test method.
The analysis of the nutritional properties of samples from the honey enriched with different levels of pollen, propolis, royal jelly and bee bread was done to demonstrate their high nutritional value compared to honey. Analysis of physicochemical composition of bee products which are used in apitherapy as functional foods is very important because it is essential to know if the products: its are authentic, have adequate chemical composition of bee product type.

Keywords: bee products, nutritional value, chemical composition, honey.

1. Introduction

Honey, a natural product traditionaly, is constituted mainly of the fructose and glucose, besides water and other components in minor concentrations such as proteins, enzymes, amino acids, phenolic compounds, minerals, vitamins, organic acids, importants substances which contributes to the health-promoting properties of honey (S.K.T. Seraglio et al., 2019; Can et al., 2015; Alvarez-Suarez et al., 2012;; Escuredo, Míguez, Fernández-González, & Seijo, 2013).

Bee products, such as pollen, propolis, royal jelly and bee bread, has be potential functional properties such as antimicrobial, anti-inflammatory and antioxidant. In this case, the interest and consumption of these as a functional products by the food industry and consumers have grown.
Bee products, such as pollen, propolis, royal jelly and bee bread, has be potential functional properties among which: hepatoprotective, chemoprotective and/or chemopreventive and anti-inflammatory, anti-radiations, antimicrobial, antifungals antimicrobial, anti-inflammatory and

antioxidant, which is attributed to their antioxidant activity (A. Pascoal et al. 2014; Fatrcova-Šramkova et al., 2013; Viuda-Martos et al., 2008). In this case, the interest and consumption of these as a functional products by the food industry and consumers have grown. Bee products present, a lower content of mosaccharides and higher values proteins, minerals, phenolic compounds, and oligosaccharides compared to honey, which contribute to its outstanding biological activities.

Thus, detailed knowledge of the composition and properties of bee products is of great importance, especially considering that bee products are still few studied and therefore undervalue.
Bee pollen is a rich source of crude fibers, proteins, lipids, essential minerals (potassium, calcium, sodium, phosphorus, magnesium, iron, manganese, copper, zinc, chromium, nickel, and selenium (Villanueva et al., 2002; A.M. Ares et al. 2018; Sattler J.A.G. et al., 2016).
The chemical composition of bee bread indicate that it is generally composed of water, free amino acids, proteins, carbohydrates, fatty acids and

other bioactive molecules, like antioxidant compounds, such as phenolic compounds, α-tocopherol, and coenzyme Q10 (Urcan et al., 2017; Zuluaga, Serratob, &Quicazana, 2015). Propolis is a complex mixture and is composed of around 50% resins and plant balsams, 30% wax, 10% essential oils, 5% pollen and 5% of other substances and materials, including organic compounds, such as phenolic compounds, particularly flavonoids (Burdock, 1998; Huang, Zhang, Wang, Li, & Hu, 2014; Pasupuleti, Sammugam, Ramesh, & Gan, 2017; Cornara, Biagi, Xiao, & Burlando, 2017; Figueiredo et al., 2017).

RJ is a whitish to yellow in colour substance, secreted from worker bees that is only consumed by the queen bee and is also fed to the larvae for brood nutrition. Its main compounds are proteins, sugars, lipids, free amino acids, vitamins and minerals. 10-hydroxy-trans-2- decenoic acid (HDEA) is an unsaturated fatty acid and a unique component in RJ. HDEA was found to have many parmacological activities such as anti-

tumor, antibiotic, and neuroprotective properties (Ito S.et al., 2012; Guo H et al., 2009; Genç M et al., 1099).

In this research, pollen, propolis, royal jelly, bee bread were used to to obtain a bee cocktail, in which honey is the principal component. Consequently, this work highlights the valuable properties of bee products and reveals a constancy of bioactivities in mixture samples of honey enriches with these, raising awareness to the potentialities of these natural bee products often regarded as a beekeeping waste.

2. Materials and methods

2.1. Materials

The honey, pollen, propolis, royal jelly and bee bread was prepared at SC APILIFE RO.

Four samples of honey with different proportions of bee products were prepared by mixing were obtained. The types of mixtures used in this study are presented in table 1.

Table 1. *The types of bee mixtures used in experimental research*

Sample	Honey	Pollen	Bee bread	Propolis	Royal jelly
I	51	17	20	5	7
II	54	18	21	5	2
III	56	18.5	21	2.5	2
IV	56	18.7	22	1.2	2.1

2.2. Chemical analysis

Moisture content was determined at 103^0C (±2 ^0C) (2 g test samples) until constant weight was attained (–FR X). The ash content was determined by incineration at 525 ± 25^0C. Total fat content was determined by extracting 10 g of sample with petroleum ether at $40-65^0C$, using a semi-automatic Soxhlet Foss Extraction System 2055 (Foss, Sweden). Total nitrogen (N) and crude protein content ($N·6.25$, conversion factor) was determined by the Kjeldahl Method (KjelMaster K-375, Buchi, Germany).

Sugar content was determined by the Schoorl method modified. The total carbohydrate content was calculated by difference: 100 - (ash content + protein content + fat content + moisture content). All experiments were performed in triplicate.

2.3. Sensory evaluation

Two methods were used for the sensory analysis of honey mixtures with bee products: Descriptive method and the Acceptance Testing

method (Lawless & Heymann, 1998; Herbert Stone & Joel L. Sidel, 2004). The Descriptive

method it was done by testing of five general sensory attributes (homogeneity, sweet taste, bitter taste, sour taste and after-taste).

Samples evaluation was performed by 15 untrained panelists in the age range 26–60 years. The consumers were asked to evaluate the sweet products using the following descriptors: homogeneity, hardness, sweet taste, bitter taste, sour taste and after-taste.

The Acceptance Testing was performed using a hedonic scale of 9 points (1 represents dislike extremely, while 9 represents extremely). All products were blind coded with random numbers and the orders of serving all samples were randomized. The sensorial tests was carried out in individual booths using fluorescent lamps (simulating daylight). Water was offered to rinse the mouth between tasting the samples in order to distinguish clearly the specific flavors.

2.4. Statistical Analysis

All analyses were performed in triplicate and the mean values with the standard deviations were reported. Microsoft Excel 2003 Program was used for statistical analysis of the data with a level of significance set at 95%. Analysis of variance (ANOVA) followed by Tukey's test was used to assess statistical differences between samples. Differences were considered significant for a value of $P < 0.05$.

3. Results and discussions

Bee products, such as pollen, propolis, royal jelly and bee bread are an interesting source of enrich the nutritional composition of honey. In addition, bee products are a rich source of protein and minerals providing beneficial effects on human's health (Pasupuleti, V. R., et al.,2017; A. Pascoal et al. 2014; Villanueva et al., 2002; Alvarez-Suarez, 2012 et al.)

The honey compositions and mixtures of the honey with different proportions of bee products are shown in table 2. The ratios of the different bee products that were incorporated were shown in Table 1.

Fig. 1. *The four mixtures used in this study*

Table 2. *Nutritional composition of mixtures used in this study*

Sample	Moisture	Ash	Protein	Lipids	Sugar	Carbohydrates
	%					
Honey	16.00	0.29	0.23	0.08	80.75	83,4
I	20.52	0.82	7.66	0.17	49.40	70,83
II	16.98	1.14	9.10	0.14	50.80	72,64
III	17.16	1.16	9.18	0.15	52.90	72,35
IV	16.85	1.16	9.39	0.14	53.25	72,46

It is apparent that the enrichment of honey with nutritionally bee products enhances the nutritional qualities of its own.

By adding bee products into honey, the protein content increased considerably, from 0.23% d.m. up to 9.39% d.m. (IV sample) (a large supply of amino acids indispensable to the human body).

Also, ash content increased in mixtures, from 0.29% d.m. honey to 1.16% in mixture IV. This thing means that honey mixtures with bee products have a much higher mineral content than honey, in direct proportionality with the

percentage increase of bee products added in the honey.

Sensory analysis of experimental variants

Sensory analysis of the four experimental variants was performed in order to choose the optimal bee cocktail variant.

The sensory analysis evaluation by the panel method of evaluators shows that samples III and IV were evaluated most favorably, compared to I and II samples (figure 2).
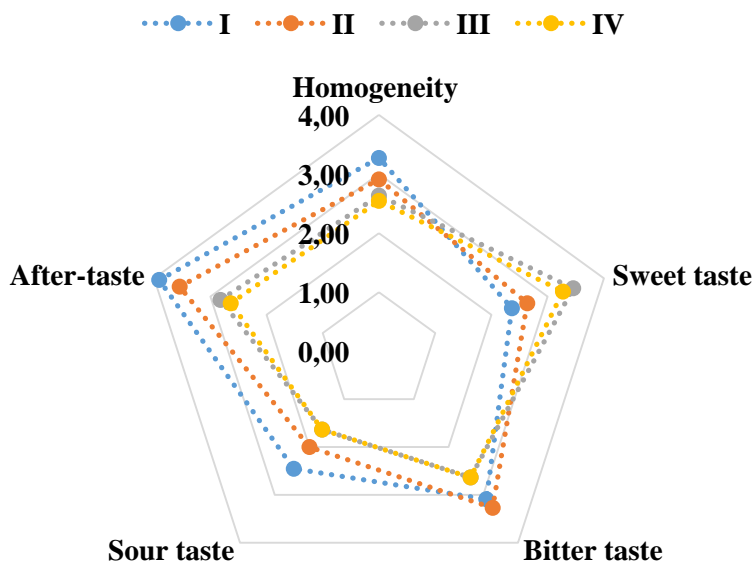
Fig.2. *Sensorial analysis of the experimental samples*

The sensory evaluation by the Acceptance test method of honey enriched with different levels of pollen, propolis, royal jelly and bee bread are shown in figure 3.
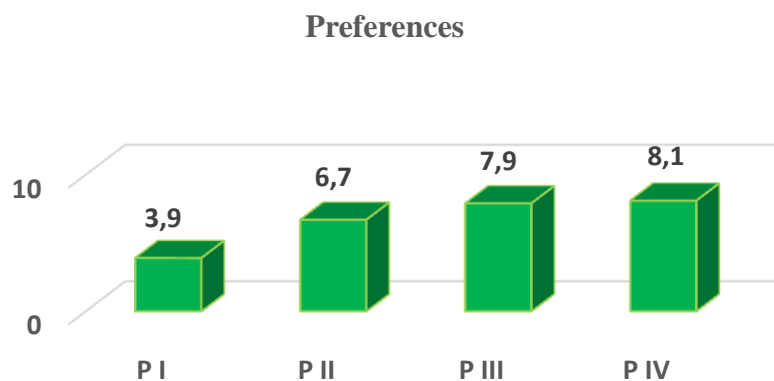

Fig. 3. *The sensory analysis of the acceptance test method*

The four experimental variants of bee mixtures obtained the following qualifications:

- P I - obtained the score 3.9 - between *"moderately displeasing"* and *"slightly displeasing"*;
- P II - obtained the score 6.7 - between *"I like it slightly "* and *"I like it moderately"*;
- P III - obtained the score 7.9 - between *"I like moderate"* and *"I like very much"*;
- P IV - obtained the score 8.1 - between *"I really like"* and *"I like extremely"*.

After performing the sensory evaluation by the acceptance test method, it can be observed that the fourth variant obtained the highest score (8.1), followed by the third variant, with a close score (7.9), compared to the other two samples.

Conclusions

The mixture/cocktail of bee products is obtained by mixing different bee products: honey, pollen raw bee bread, propolis, apilarnil, royal jelly, in different quantities selectively and it is fruit of a research of IBA Bucharest with APILIFE RO.

It is expected that this work would be an tool for recognizing bee products as being a valuable source of natural nutrients for human nutrition and health.

Studied and thought to wishlist green house sanogenous of the most powerful, balanced, generous we combines synergistically bee products.

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