

Scientific Articles
International Conference
**“AGRICULTURE AND FOOD FOR THE
XXI CENTURY”**

Celebrating the XXV Anniversary of Agronomy Higher Education in
Sibiu

CONFERENCE SECTIONS

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Protection**

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HEALTHCARE MANAGEMENT

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Scientific Articles of the International Conference AGRI-FOOD 2017
“AGRICULTURE AND FOOD FOR THE XXI CENTURY”

May 11-13, 2017, Sibiu, Romania

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Dear guests and distinguished colleagues,

I have widely opened the time window and I've looked back. Where have already passed 25 years? How many of our beginning dreams have become reality and how many are still waiting to be transformed into reality? In mankind history, 25 years are only a blink of an eye, but for us they are years of teaching and thorough research, to put the name of Lucian Blaga University of Sibiu, by means of the Faculty of Agricultural Sciences, Food Industry and Environmental Protection on the map of agronomy higher education. Was it a hard way? We consider it wasn't, because when you work with pleasure, you are dedicated to live the feeling of spiritual fulfillment.

In a quite short period of time, a quarter of a century, the specialization "Montanology" of the Faculty of Agricultural Sciences, Food Industry and Environmental Protection has managed to define its role as trainer for professional elites. We have been continuously preoccupied by developing the professional skills and competences of our students, adapted to the demands of today's labor market and of the entrepreneurial society, constantly focusing on the modernization of teaching and research approaches, in order to provide the competences and to reach the performance standards for the future agriculture specialists, graduates of license and master programs.

The academic staff was always preoccupied by the harmonization of the teaching process with the national and international trends, and this was possible by developing partnership relations with similar universities, from Romania and Europe, by adapting our curricula and research areas to the national and abroad ones.

The visibility of our specialization is granted by the professional prestige of our 20 members of the teaching staff, whose concern towards the quality of the teaching is harmoniously combined with the results from their scientific research activity, these enabling our Faculty to be an excellence pole within the University, and not only.

The academic staff was involved during these 25 years in many research grants, has published more than 60 ISI papers and other 720 in prestigious journals from Romania and abroad. We are involved in many SOP-HRD projects, by which we provide our students with practical training, entrepreneurial formation, etc.

But the most we are proud because our students which, after being "polished" by the academic staff during four years, represent genuine "jewels", spread all over the country, making the expression "A good farmer makes a good farm" to be backed by reality. In mayoralities, agriculture boards, animal or vegetal farms, B&B houses, in education (primary, secondary or higher), in state or private jobs, our graduates have rapidly integrated into a very fluid and unpredictable labor market, and these celebrations represent a good opportunity to enjoy together the fact that the efforts of

our teaching staff have resonated in the souls of our students, then graduates, that became not only good specialists, but true HUMANS.

From our best graduates, eight have completed their professional training by doctoral studies, obtained in prestigious universities from Romania and abroad.

Making a honest analysis of the achievements and flaws of all these years, we can state that we have sowed the “miraculous seed” of agricultural science and research in Sibiu, and we fully enjoy the results of our work. The efforts and endeavor of the whole “Montanology” staff during this quarter of a century enable us to look forward towards excellence, corresponding to the knowledge-based society, and to the prestige consolidation of the Faculty and of the Lucian Blaga University, worldwide. We have all the capabilities to focus the teaching process on new bases, making the agronomy higher education of Sibiu compatible with the Romanian and European one.

VIVAT, CRESCAT, FLOREAT!

With the highest consideration and warmest gratitude,

Sibiu, May 12, 2017

DEAN,

Proffesor Camelia SAVA, Ph.D



Foreword of the Director of the Department of Agricultural Sciences and Food Engineering

In 2017 we celebrate with great honor the 25th anniversary of agricultural higher education at the Faculty of Agricultural Sciences, Food Industry and Environmental Protection – a "young" faculty founded in 1990 initially focused on food education of great significance for the overall evolution of the "Lucian Blaga" University of Sibiu.

The existing agricultural traditions and rural gastronomic culture in the Sibiu area have facilitated the development of agricultural studies at higher education, as well. The development of the faculty has been a successful one that has led to important achievements with the diversification of study programs in consensus with the scientific progress in the field, new technologies and challenges of the Romanian society.

It is worth noting not only the constant concern for the development of new curricula and the improvement of the existing infrastructure, but also the enthusiasm and the devotion of the academic staff who understood that the education of students must be done alongside with the scientific research through which students are guided to find their own way for professional evolution. For this, a lot of scientific publications, monographs, patents and research projects are testified.

These constant concerns have succeeded over the years in attracting many students, whose efforts during the studying years have been rewarded by their involvement in educational and scientific activities and projects together with the academic staff of the faculty and by the recognition of their professional skills through the employment in institutions and companies in the field; this, in an increasingly competitive labor market. Our graduate students have continued to join the faculty's efforts to integrate into a European educational system and to create strong partnerships between the academic community and the private corporations.

I would like to acknowledge each and every one of my colleagues from the Faculty of Agricultural Sciences, Food Industry and Environmental Protection for all the achievements so far and I wish them the best in on-going their works to make the agri-food higher education at Sibiu an attractive one at national and international level, both for students and for the academic society.

Sibiu, May 12, 2017

With the most kind thoughts and consideration,

DIRECTOR OF THE DEPARTMENT,
Professor Simona OANCEA Ph.D

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BETWEEN PLANT GENETIC RESOURCES FOR FOOD AND AGRICULTURE AND CULINARY TOURISM.

Minireview

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Abstract:

In the past ten years, the culinary tourism is getting more and more visibility on the tourism marketplace, due to the taste experience of a specific group of tourists. However, the connection between the origin of taste and recipes was not discussed yet as well as the sustainable use of raw products of food importance in the place of origin. On the other hand, we are witnessing today the erosion of genetic resources for food and agriculture in remote places that may become destinations for culinary tourism. The scope of this article is to discuss some potential ways of connecting the conservation of plant genetic resources for food and agriculture to culinary tourism and to define gastronomic fingerprint for producers, suppliers and consumers to ensure the resilience of local communities for the future.

Key words: PGRFA conservation, on farm gene banks, gastronomic fingerprint, culinary tourism

INTRODUCTION

Conserving genetic resources for food and agriculture (GRFA) becomes more and more relevant for ensuring food security of our future (Oguamanam, 2016). Humans constantly accessed during their evolutions, millions of years ago, wild species for food and feed and some of them are part of the today global bioeconomy such as wheat, maize, rice and potatoes, pork meat and so on (Bruford et al., 2017). Their inclusion into the global economy is ensuring the constant access to these genetic resources making them among the most visible GRFA all over the world (Galluzzi, et al., 2016).

The visual impact, due to commercialization under WTO is strong (Montenegro de Wit, 2017), when it is considered that not advertised plant genetic resources for food and agriculture PGRFA may be at risks of extinction due to the erosion of knowledge related to the usefulness of the species (Thormann & Engels, 2015). Moreover, during time people developed a specific knowledge related to the access and use of these PGRFA that is part of traditional knowledge (TK) with a significant impact on their social life and local economy (Salgotra & Gupta, 2015).

However, each local community needs to address their own peculiarities in economic terms related to local natural resources on a sustainable basic consumptions scheme (Sthapit et al., 2017) as not all natural resources are renewable (Holden et al., 2014).

Food security mainly relays, when considering only natural resources as primarily factors, on land use, soil, water, climate and biodiversity (i.e. maximum richness of species and habitats for a certain agro-ecosystem). Secondary factors must be defined for each agro-ecosystem due to peculiarities of the regions from political point of view too (Uddin et al., 2014).

The scope of this article is to envisage an analytic framework for assessing innovative economic catalysts in ensuring GRFA conservation and sustainable use for long term.

RESULTS AND DISCUSSIONS

Many strategic tools have been developed during time for ensuring local communities development considering local, regional or global factors (Ioppolo et al., 2016). However, most of them are looking local communities from a mirror perspective by which the local economy is reflected for the outside community, as depending mainly on regional or national economy. Such analysis need to include a profound analysis of describing all possible economic processes related to local communities (i.e. specific to microeconomy).

Such an approach in the context of developing new strategies for PGRFA conservation may be related to local gastronomy that is the very basis for gastronomic tourism. Based on this, local gastronomy as a trigger of culinary tourism (Lee et al., 2015), may provide the sense and direction we need in more understanding the need for preserving all local PEGFRA relevant for local gastronomy in line with the provisions of art. 5 of International Treaty on Plant Genetic Resources for Food and Agriculture or Plant Treaty (Tvedt, 2015).

In ensuring such an approach understanding we will discuss the traditional knowledge scheme presented in Fig.1. A four steps process in defining and understanding TK in direct connection with nature, resources management, social and economic issues as well as local, regional and global factors interfering with local communities is depicted.

For each of them risks need to be addressed to evaluate for each global factor local impact on natural resources management. On the other hand, for each type of TK it is relevant to be identified economic risks for a resilient community (i.e. local or indigenous local community).

TK related to nature such as wild and domestic species (i.e. diversity, management, use, access) is the first component of the local knowledge as it relates directly to food security for resilient communities. Accessing and using the diversity of the species for the survival of community is among the primary factors grounding its resilience (Vernooy et al., 2017).

Furthermore, landscaping and specific use of other natural resources (i.e. water, soil, land, mining, etc) became relevant pillars in the development of TK when only considering today the greening of the cities (Connop et al., 2016).

Furthermore, social and economic components of the rural community comprise features such as: religions, beliefs, handicrafts, traditional jobs and services as well as local gastronomy (Timothy, 2016). They are catalysts for local emerging economy. From this point of view local gastronomy become part of a new branch of tourism in Sibiu (Richards & Rotariu, 2013) the culinary tourism with a recent history (Germann Molz, (2007).

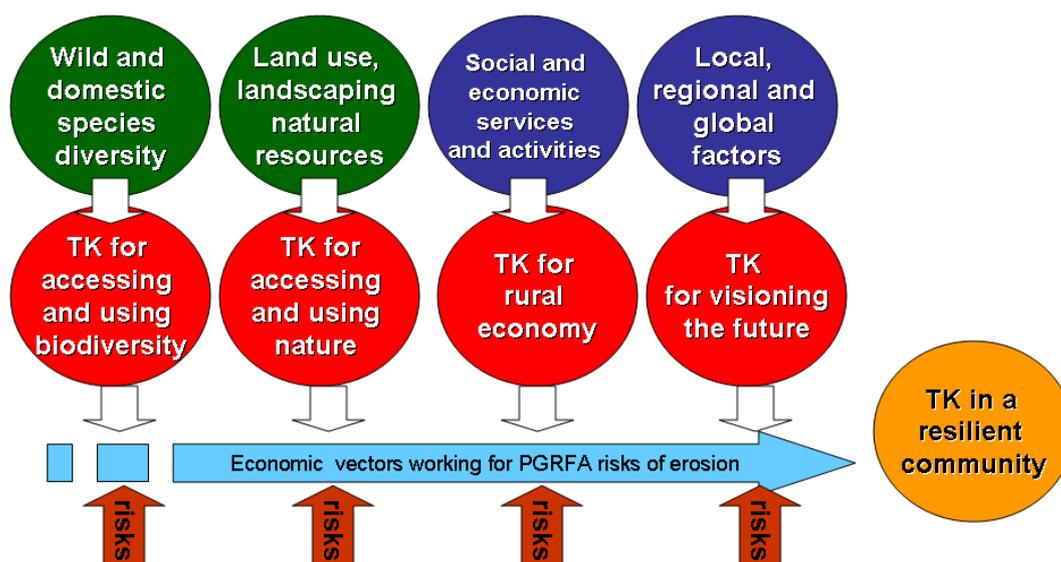


Figure 1 A traditional knowledge approach in assessing PGRFA and economic impact on rural communities

Based on this scheme it became obviously that local gastronomy has a specific place in the centre of rural community directly connected to the conservation of genetic resources for food and agriculture and TK related to the direct access and use of natural resources and existing of a non-tangible heritage connected with the history of the place.

The erosion of TK related to the access and use of local heritage will further contribute to the erosion of local gastronomy as a potential economic service.

Local gastronomy became in the past 10 a relevant part of local tourism as a new branch of the general tourism (Kivela, 2017).

The fourth part of the TK is mainly devoted to local, regional and global factors that are the major triggers in influencing the resilience of communities. However, local communities, rely on the sustainable exploitation of local resources embodied into the social culture and reflected in the local economy (Stock & Burton, 2011).

The current major approaches in assessing local communities are devoted to evaluating the economic impact on local communities without considering the TK related to the access and use of tangible and not tangible heritage (i.e. wild species, landscaping, local gastronomy, the resilience of community) and related to the history of the place.

By considering all features of TK it is possible to improve results in developing strategies for the sustainability of any community. Also, slow food as a global movement that is looking in accessing and developing local economy is highly promoting on the other hand, local taste based on local products (Hsu, 2015).

Only considering TK related to local gastronomy it generates new concepts needs such as: genetic resources and landscaping for local gastronomy. In other words, local taste generates new concepts for ensuring the conservation and sustainable development of local gastronomy and to support old concepts already developed by the FAO for food security such as:

- *on farm* conservation of genetic resources (gene banks) (Khoury et al., 2014);
- official recognition at the local, regional up to national level of local varieties of crops and animal races (Ghasab et al., 2015);
- recognition of landscaping impact on the culinary tourism development especially in remote communities (Tan & Bakar, 2016);
- branding wild and domestic biodiversity with a potential impact on the resilience of local communities (Aarssen, 2013).

The direct connection between used wild or domesticated species and local gastronomy may trigger the need of new concepts such as *gastronomical fingerprint*.

Fingerprinting is a concept that fuels the development of genetics of species (Finn et al., 2015) or it is used in informatics (Kopparty et al., 2016). However, transferring this knowledge to gastronomic tourism it becomes obviously that food resources are the most *valuable variables* in a rural community.

Thus, *wild or domesticated species are central pillars for the success of a local taste in local gastronomy*.

Gastronomic fingerprint may be defined for [1] locals (when they are providing food with local resources of unique taste) [2] producers, [3] suppliers (the suppliers of raw materials for food) and [4] consumers (e.g. eat local for 365 days per year).

The concept may become a brand for local communities that are committed to support the local taste by accessing local genetic resources in a specific landscape and provided with the history of the place.

Local communities may have the opportunity *to map their own local gastronomic recipes* directly connected with local resources as major ingredients (i.e. landraces and local races, wild edible plant species) and history of the place in promoting culinary tourism. To secure their local resources they may have the chance to ground the need for *on farm gene banks recognition*.

To support the regional development, the gastronomic fingerprinting of suppliers and producers may provide the opportunity for officials to support local economy in a regional context.

The bottlenecks of the process may be due to the lack of networking between locals, producers, suppliers and consumers as well as by the lack of regional commitment in ensuring local community sustainable development.

Consumers may become aware about their own choice when they are going to the market for ensuring their needs for a quality food if they are mapping the source of their food. Moreover, marketing in the region is increasing commitments of all stakeholders: producers, suppliers and consumers if they want to contribute to the regional development.

CONCLUSIONS

Local gastronomy may generate new concepts such as gastronomic fingerprint for mapping local resources, the raw materials for producers in local markets and consumers. Gastronomic tourism may become a central pillar in the future evaluation of PGRFA as well as of animal races, to ensuring their further conservation and sustainable use. Constant awareness of food quality maintenance may function better between producers, suppliers and consumers (Lähteenmäki, 2014).

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THE SOCIO-CULTURAL ASPECTS OF SIBIU’S TRADITIONAL GASTRONOMY, A LABEL OF SPECIFICITY FOR CULINARY TOURISM AND EUROPEAN REGION OF GASTRONOMY 2019

Maria BARNA

“Cindrelul – Junii” “Centre for Preservation and Promotion of Traditional Culture in Sibiu County

Abstract

20th and 21st century’s rapid transformations and accelerated industrialization have determined changes in Romanians’ food habits, food production, processing and cooking. International gastronomy and industrial food tend to replace traditional ingredients, recipes and the way inland food is perceived.

Traditional gastronomy encompasses important nutritional information, representative symbols and ideologies. Simplicity of cooking, inventive reuse of basic food, adaptation to the cycles of men’s and nature’s lives, home-cooking and the rich socio-cultural background behind each meal are the main characteristics of our specific gastronomy.

Considering the facts that food comprises 30% of tourists’ expenditure and that food tourism is a growing market, local gastronomy should be enhanced by its socio-cultural background. By analyzing the menus of 10 local restaurants and the concepts behind 4 gastronomic events, findings of the paper show that specific socio-cultural aspects of inland gastronomy should be more highlighted. Good practice examples come from agro-tourism and peasants’ organic farms. In 2019, Sibiu has the opportunity to emphasize the story and uniqueness of its gastronomy, by promoting the socio-cultural context, so strongly linked with healthy food and well-being.

Keywords: food, traditional gastronomy, tourism, gastronomic events, local authenticity

INTRODUCTION

Travel, accommodation, food and drinks, recreation activities and shopping are the main categories of a tourist’s consumption expenditure and the basics segments of the tourist processes. But in the last decades, worldwide tourism lives an important change, determining a new type of tourism: the gastronomic one. In other words, food remains a basic need for tourists, but it also reaches the status of *purpose of tourism*: people travel more and more in order to taste and enjoy different cuisines, food becomes a “medium, a destination and vehicle for tourism”. In this context, food experiences, local food culture, gastronomic tourism, culinary tourism, and repositioning food as a creative industry – all these terms and concepts have lately been widely approached by tourism operators and researchers.

In a highly globalized environment, people travel from one region to another, from one country to another, from one continent to another in order to live the local experiences and to know the local culture. Food is perceived as an important part of culture and identity,

and gastronomy is rapidly growing as a renowned part of the local culture and an indispensable element in order to get to know the culture and lifestyle of a territory. Thus, gastronomy is perceived as a genuine embodiment of the “traditional values associated with the new trends in tourism: respect for culture and tradition, a healthy lifestyle, authenticity, sustainability, experience... Likewise, gastronomy represents an opportunity to revitalize and diversify tourism, promotes local economic development, involves different professional sectors (producers, chefs, markets, etc.), and brings new uses to the primary sector” [6, 10].

These new uses to the primary sectors are translated through food events, gastronomic routes, cooking classes and visits to markets. Analyzing the success of food perspective in tourism, a study published inside the *Global Report on Food Tourism* states the fact that 79% of respondents seek for food events, 62% - for gastronomic routes and cooking classes, 53% of them - for food fairs and visits to market and producers [6, 13-14]. Moreover, food often comprises 30% percent of tourist expenditures [4, 9] and this rate grows even more if we refer to food tourism. Still, food tourism is in its inception, there are countries where gastronomy is not yet a tourist attraction [1, 2] and there are countries worldwide recognized for the strong connection between cultural tourism and food (see the examples of Italy and France).

In this context, traditional gastronomy can play an even more important role since it is the tourism segment that manages to connect the tourist with the local identity and culture through a basic service in tourism. The importance of local food culture has been greatly underlined by tourism operators, international organizations and public demand. The Organization for Economic Co-operation and Development (OECD) admits that “one of the key values of food experiences is their link to the local; to specific landscapes, cultures, creative expressions, etc.” [4, 37], but also to authenticity. In the contemporary world, food tends to be globalized or to globalize itself: you can eat pasta in Italy, but also in the United States of America, Romania or Australia. So, there is an emergent need to support and promote the idea that a genuine experiencing of food must take place in its specific place, at its best. Communicating this to tourists is essential in order to be able to transform food from a basic need into a purpose of tourism. Traditional gastronomy has this chance due to the fact that food is always surrounded by stories of how the food is cooked, how the recipes are being passed from one generation to the other, of the social and cultural occasions when a specific food was served. On the other hand, traditional gastronomy tourism brings benefits in the social and cultural life, in economics and sustainable development of communities. This

brings up the following question: How to make the shift from tourists just eating to tourists visiting for food? Eight elements are to be followed, according to OECD's suggestions:

- the authenticity of local food: food experiences must be related to the specific of the place, to its landscape, to culture and creative expressions in order to be able to tell the story of authenticity to tourists;
- quality and consistency of food: this necessity arises from the quality of products and goes to the certification of quality, by following the international rules regarding products labeled Protected Designation of Origin, Protected Geographical Indication or Traditional Speciality Guaranteed. These labels “attest the specific traditions and qualities of food, agricultural products and wines, aromatized wines and spirit drinks, produced in the European Union or in other countries” and through the logos, tourists are able to recognize high-quality, authentic, traditional food. [3, 102];
- ensuring sustainability: tourism can increase demand for local products, thus contributing to the prosperity and growing business rate of local producers;
- building networks of stakeholders;
- repositioning food as a creative industry and an important tourist attraction;
- -marketing and a good image are determinant for the success of food;
- creating and implementing a holistic approach, that is to deal with food and tourism in an integrative concept, beginning with agriculture and food production, going through cultural events and branding, for example;
- developing scientific researches as there is still little information on culinary tourism and food tourists.

RESEARCH METHODS

This paper aims to determine the socio-cultural aspects of Sibiu's traditional gastronomy and of the food events organized, in order to acknowledge and emphasize Sibiu's specificity for culinary tourism and for the program European Region of Gastronomy 2019. In this context, it is necessary to underline some characteristics of Romanian traditional gastronomy and to measure the extent to which it responds to OECD's eight suggestions.

Afterwards a question must be answered: does Sibiu offer the environment for a proper and genuine culinary tourism and for developing into a successful European Region of Gastronomy? In order to suggest an answer, there should be analyzed the menus of local

restaurants, the concepts behind some gastronomic events organized in Sibiu county and practices from agro-tourism.

In this context, the present research is based on the direct observation of several food and cultural events; these field research data are to be discussed through information regarding tourists` reception in order to evaluate the success of their concept and implementation.

RESULTS AND DISCUSSIONS

Sibiu`s **traditional gastronomy** has not benefited up to know from an integrated scientific study. There have been researches made to determine representative recipes, symbols and ideologies and their linkage to the traditional culture and civilization; in this context we must mention the field researches conducted by “Cindrelul - Junii” Centre for Preservation and Promotion of Traditional Culture in Sibiu County, the book *Rețete tradiționale din Județul Sibiu / Traditional recipes from Sibiu County* and the multimedia DVD *Popasuri culinare în ținutul Sibiului / A culinary journey in Sibiu*. There have also been conducted scientific researches in order to determine nutritional information and the chemical composition of local food products, like the cheese called *telemea*. Still there is no extensive, interdisciplinary study to encompass information on local gastronomy from a cultural, nutritional, economic and tourist perspective.

In this context, it is necessary to emphasize some characteristics determining the specific of our gastronomy, from a socio-cultural point of view, and its importance from a marketing perspective:

- simplicity of cooking, due to the hard work in agriculture, peasant women cooked simple but nutritious meals; this simplicity can be the starting point of developing live cooking demonstrations and gastronomy classes;

- inventive reuse of basic food: for example, corn flour was the main ingredient used for a cake called *mălai*, but also for main courses *polenta* and *morândău*; such tasty recipes can be presented in food fairs and cooking classes;

- adaptation to the cycles of men`s and nature`s lives: in traditional civilization people used to eat according to nature`s cycles and this characteristic can be exploited in creating differentiated menus according to seasons;

- rich socio-cultural environment: in Romanian culture, food created a genuine folk literature and is deeply connected to traditions and rituals; and stories attract tourists.

It is thus obvious that Sibiu`s traditional gastronomy is able to provide the context for a successful story in tourism. But is this a successful story? Can we talk about a culinary tourism in Sibiu? Do socio-cultural aspects of local gastronomy provide a label of specificity for European Region of Gastronomy 2019? There are certain events in Sibiu that can offer answer suggestions. But in order to find them out, we should make a difference between the two environments where local gastronomy can be known, that is the rural area and the urban one, from Sibiu county.

The rural area is highly appreciated by tourists, due to the specific architecture, traditional lifestyle, cultural specific, natural landscape and tranquility. Gastronomy is part of the civilization and manages to make the shift from tourists just eating to tourists visiting for food: in our region, this fact is proven by the success of some rural festivals, of tourist programs implemented in some organic farms and by the success of food events.

Two **cultural festivals** - Cheese and Plum Brandy Festival, held in August, in Rășinari village, and “Bujorul de munte” Festival, organized in July in Gura Râului village – have managed to develop a specific and authentic concept, that brings together traditional culture, expressed through songs and dances, with traditional gastronomy and pastoral civilization. Both villages are located in Mărginimea Sibiului pastoral area and both festivals aim to promote local lifestyle, local food products and producers, in order to draw attention on the positive and successful ways to exploit our rich cultural and gastronomic heritage. Thus, meat stew, dairy and polenta dishes are traditionally being prepared in cauldrons and on burning charcoals, in front of tourists. Sausages, wursts, jelly, pork, rinds, meat in lard jars, salt greaves, prepared during the Christmas fastening period, are also consumed, along with cheese products, which are, ”par excellence, inscribed in the culinary and cultural tradition of this area” [5, 26].

The success of these festivals resides in respecting the rules of a successful (gastronomic) tourism:

- they bring forward the local authenticity,
- they deeply connect food with culture (both festivals manage to recreate slices of shepherds` lives: the concept of dinner at sheepfold, young riders welcoming guests, traditional crafts competitions),
- they benefit from a good marketing and media partnerships with national television stations,

- they develop through a networking of stakeholders created by local authorities and strong partnerships.



Foto 1 - **Cooking demonstration at Bujorul de Munte Festival**

Legend: Bujorul de Munte Festival, 2010. Source: personal archive

Both festivals have been founded about the same time (Bujorul de Munte Festival – in 2004, Cheese and Plum Brandy Festival - in 2005) and have a similar public, from a quantitative perspective, around 10000 - 12000 spectators.

The cited festivals have been created and developed by local authorities, but there are examples of good practice coming from the private area: **Transylvanian Brunch** is one of them. The concept of this food event is theorized on the organizer’s website: “We search for old, forgotten recipes and cook them with the local communities, neighborhoods or families in the villages. Therefore we use only local and seasonal products. Experience the local culture during a hike and a tour of the village” [7]. The Transylvanian brunches started in

2008 and are held monthly, in a different village, all along the tourist season, from April till September; it is a concept event, centered on specific gastronomy, which is always related to tangible, intangible and natural heritage.



**Foto 2 - Traditional sausages, inside the Saxon Fortified Church from Cristian,
Sibiu County**

Legend: Long time ago, food was preserved inside the Bacon Tower of the Saxon Fortified Churches.

Source: personal archive

Local communities are involved all along the organization and implementation process: peasants are the ones to suggest the recipes and cook the food; peasants hosts the brunches in fortified churches, in vegetable gardens or courtyards, in order to give the genuine, authentic settlement for the food being served; peasants involve participants in singing and dancing. Thus, the Transylvanian Brunches have managed to develop a unique concept, in the benefit of both tourists and rural communities: on the one hand tourists enjoy good food, merry atmosphere and feel the core of traditional civilization; on the other hand, local communities cooperate with tourism professionals, promote their business and meet potential clients.

These concept events are very well received by tourists (foreigners and Romanian urban residents), about 200 people taking part at every brunch. The events series benefits from a very good publicity in the online media, famous Romanian blogs

(<https://cristianchinabirta.ro> and travelgirls.ro, e.g.) writing about Transylvanian Brunch. Thus, it must be noted that in this case the online promotion is the most important, while in the case of the two rural festivals, publicity by word of mouth holds a significant importance.

Bio-Moşna is a *peasants` organic farm*, situated in Moşna village, close to Mediaş city. Years ago, Willy and Lavinia Schuster left Germany for Romania and established here an organic farm, breeding animals and working the land. Their farm is an example of promoting local, organic food, as it can be visited by anyone and meals can be served here. Respecting old methods of agriculture, Schuster family wants to prove that a peasant's farm provides an example of good practices and manages to attract customers and tourists. Nowadays, in Sibiu, such open farms are not yet a common view; still with a proper marketing, they have the chance to become a success in promoting authentic, organic food and local values.

In the urban environment of Sibiu city, gastronomy is promoted in restaurants and through culinary events, like fairs and festivals, organized mainly from spring to autumn.

175 is the total number of **restaurants** in Sibiu County according to the bid book of the program Sibiu – European Region of Gastronomy and 150 of them, all located in Sibiu, are listed on tripadvisor.com. Their menus offer a wide range of worldwide cuisine, from Romanian, to Central European, Central Asian, Mediterranean, North and South American, vegetarian, fusion etc. Romanian traditional dishes are offered in most restaurants, though there are few restaurants dedicated only to our gastronomy. Peasant stew with polenta, stuffed cabbage leaves, tripe soup, meatball soup, bean and smoked meat soup, red orach soup, grilled minced meat rolls, meat stew, steamed cabbage with pork ribs, vegetable stew, pea stew, stew made from pan-fried cubed pork, pork sausage and grilled minced meat rolls, fried dough, sweetened curd cheese, jam and cream – are some of the traditional dishes served. They are famous and constitute an important part of marketing the traditional gastronomy, but they should go along with local dishes, specific to Sibiu, which are, unfortunately, seldom prepared. Caraway soup with croutons, soup with pork leg and tarragon, Saxon potatoes, polenta with cheese, pastrami and sausage are only some examples of dishes that could be inserted in menus.

CONCLUSIONS

Previously, there have been asked two questions: "Can we talk about a culinary tourism in Sibiu? Do socio-cultural aspects of local gastronomy provide a label of specificity for European Region of Gastronomy 2019?" Sibiu is not yet a recognized destination for culinary tourism, but it has been awarded the title European Region of Gastronomy 2019, so it has a great opportunity to develop a sustainable culinary tourism. The local gastronomy and all its accompanying socio-cultural aspects provide not only a strong argument in this respect, but are a great attraction for tourists. This fact is highly proven by the cited cultural and gastronomic events; still these examples of good practice should be augmented by more similar initiatives, by a coherent and unitary agenda of food events and by introducing local delicacies in restaurant menus.

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GIS – A USEFUL TOOL FOR MONITORING CLIMATIC CHANGES IN SIBIU COUNTY, ROMANIA

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Abstract

Climate changes have an increasingly obvious and stronger impact on natural ecosystems, respectively, by changes in the level of phytocoenoses. Adopting the best decisions on sustainable management must be based on instruments tailored to new realities, and the technical solutions offered to decision-makers will be based on the latest technological developments. The present study aims to provide an easy decision-making tool, Based on Open Source developments, using both local authority data and data provided by major global operators or even by the European Space Agency.

Keywords: sustainable management, climate change, GIS

INTRODUCTION

To prevent and attenuate the climate changes, Romania has committed to preserving and protecting the natural heritage, declaring protected areas of national interest: scientific reserves, national parks, natural monuments, nature reserves, natural parks; international interest: natural sites of universal natural heritage, geoparks, wetlands of international importance, biosphere reserves; international interest: natural sites of universal natural heritage, geoparks, wetlands of international importance, biosphere reserves; community interest: Sites of Community Importance (SCI), Special Areas of Conservation, Bird Special Protection Areas (SPA) [5].

Natura 2000 is the key instrument to protect biodiversity in the European Union. It is an ecological network of protected areas, set up to ensure the survival of Europe's most valuable species and habitats. Natura 2000 is based on the 1979 Birds Directive and the 1992 Habitats Directive. This version covers the reporting in 2016.

GIS provides solutions to complex analysis on the managerial level through technical solutions provided by management plans and measures taken in the past [1].

The main legal sphere, which should be regulated in terms of the provisions for spatial planning and development, should be solving problems in the field of digitization of planning

documents, i.e. the studies of conditions and directions of spatial development at municipalities, and local development (zoning) plans [4].

MATERIALS AND METHODS

The evolution of terrestrial ecosystems, especially forest formations, has been achieved over time by direct observations and measurements, and the results were recorded at the local authority level and then centralized at central government level. In the last period, to monitor the evolution of forest ecosystems, applications installed on mobile devices (smartphones, dedicated GPS), as well as desktop applications, are used.

The applicative part of the researches was carried out in the Sibiu-Rășinari-Păltiniș area, having the GIS data base provided by the Rășinari Forest District (fig. 1). The spatial data were vectorized in a geodatabase format, and the database containing the management plan (forestry arrangement) was integrated into the GIS [2].

The raster images were obtained from the Institute of Research and Development in Forestry Marin Dracea, from aerospace agents, or satellite imagery provided by global operators (Alphabet, Microsoft, USGS - U.S. Geological Survey, ESA). The European Space Agency (ESA) is Europe's gateway to space. Its mission is to shape the development of Europe's space capability and ensure that investment in space continues to deliver benefits to the citizens of Europe and the world. SENTINEL-2 makes a significant contribution to Copernicus themes such as climate change, land monitoring, emergency management, and security. With its 13 spectral bands, 290 km swath width and high revisit frequency, SENTINEL-2's MSI instrument supports a wide range of land studies and programs, and reduces the time required to build a European cloud-free image archive. The spectral bands of SENTINEL-2 will provide data for land cover/change classification, atmospheric correction and cloud/snow separation. The USGS operates the Landsat satellites and provides the Nation's portal to the largest archive of remotely sensed land data in the world, supplying access to current and historical images. These images serve many purposes from assessing the impact of natural disasters to monitoring global agricultural production [6], [8].

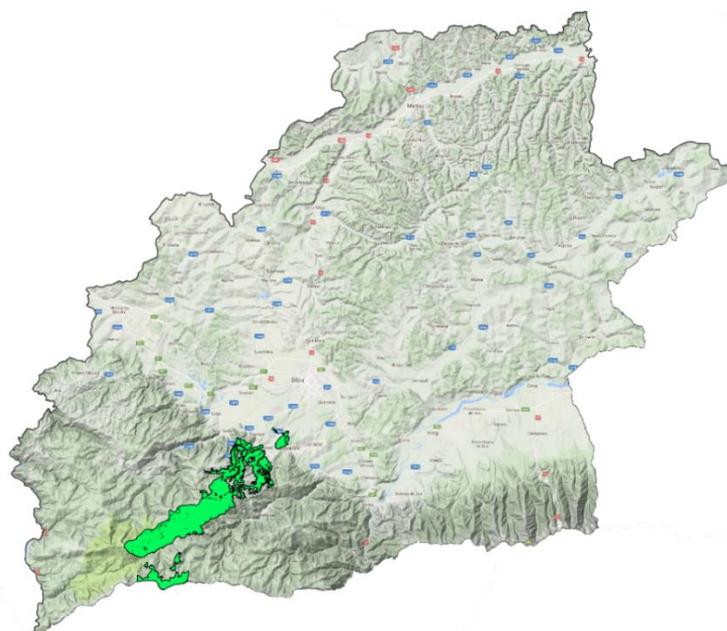


Fig. 1. Place of study.

RESULT AND DISCUSSIONS

The area on which vegetation evolution is monitored is 9 962.2 ha, summarized in the table 1.

Table 1 Synthetic indicators on the vegetation characteristic

Surface ha	Alt. min. M	Alt. max. m	Number of experimental plots	Spruce		Pine		Beech		Oak		Other deciduous	
				%	ha	%	ha	%	ha	%	ha	%	ha
9962.2	490	2235	1121	63	6276.2	7	697.4	21	2092.1	6	597.7	3	298.8

On the field, data were collected using Locus Map running on devices with Android operating system, and data analysis was performed with Quantum GIS.

The geospatial database is retrieved in the Locus Map application, who have the advantage, for better orientation in the field, that using maps and images offline. For this study are used Google Satellite images with a resolution that allows 17x zoom.

In fig. 2 is showed how to locate and identify the surface.

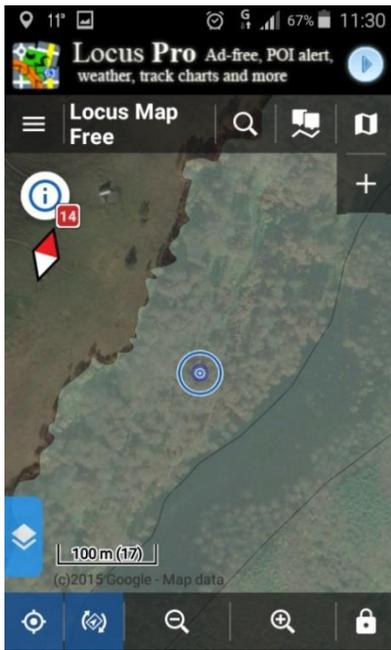


Fig. 2. Screen shoot of the location within the plot area.

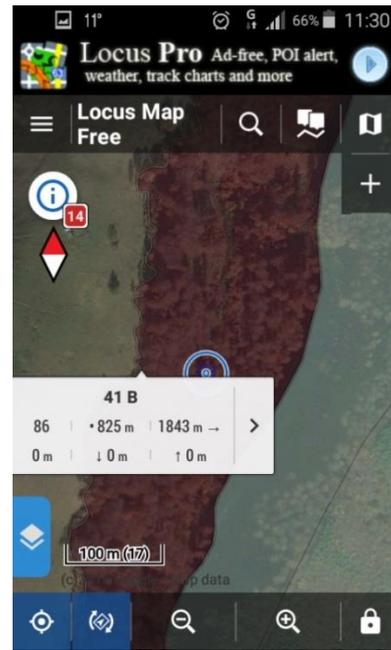


Fig. 3. Identifying the plot area

Surface identification is achieved by touching the device screen (fig. 3). In addition to locating and querying, the application also allows data acquisition.

After locating the surface, by querying the database, the information attached to the polygon in which the operator is positioned (fig. 4).



Fig. 4. Querying database

After collecting and verifying field data, processing and interpreting the results was done with QGIS. The GIS database (geodatabase or shapefile) is overlap on high-resolution

satellite imagery. This study used images provided by ESA through the Sentinel 2 service (fig. 5).

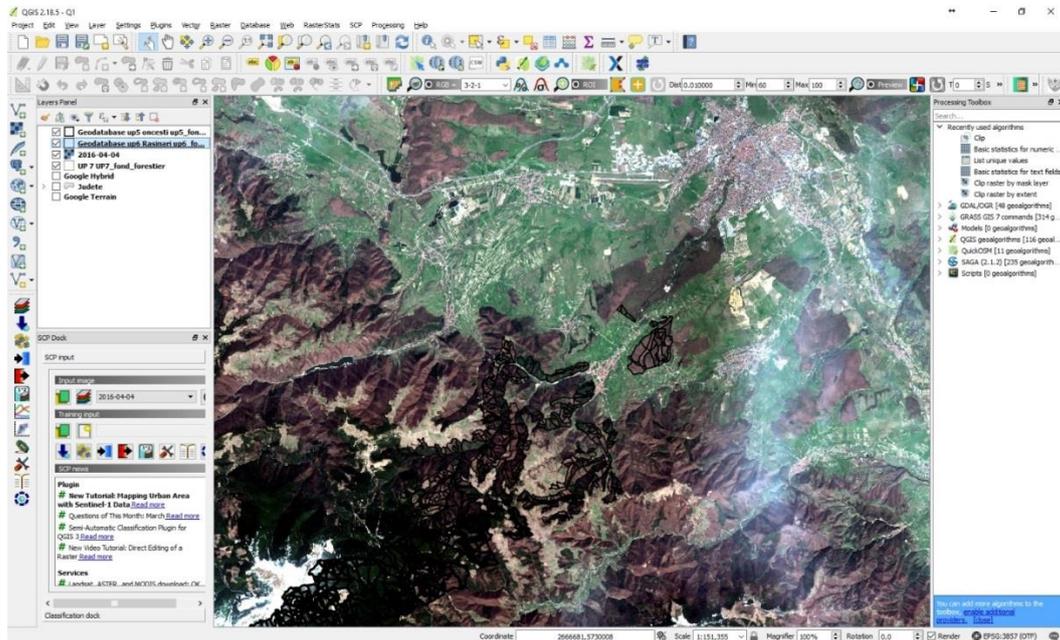


Fig. 5. Using Sentinel image in QGIS

Image classification was done using the Semi-Automatic Classification Plugin plug-in, Sentinel images using band 2, 3, 4 and 8.

Also in this stage can be determined NDVI (normalized differential vegetation index), applying the algorithm for bands 4 and 8 (NRED and IRED) (fig. 6).

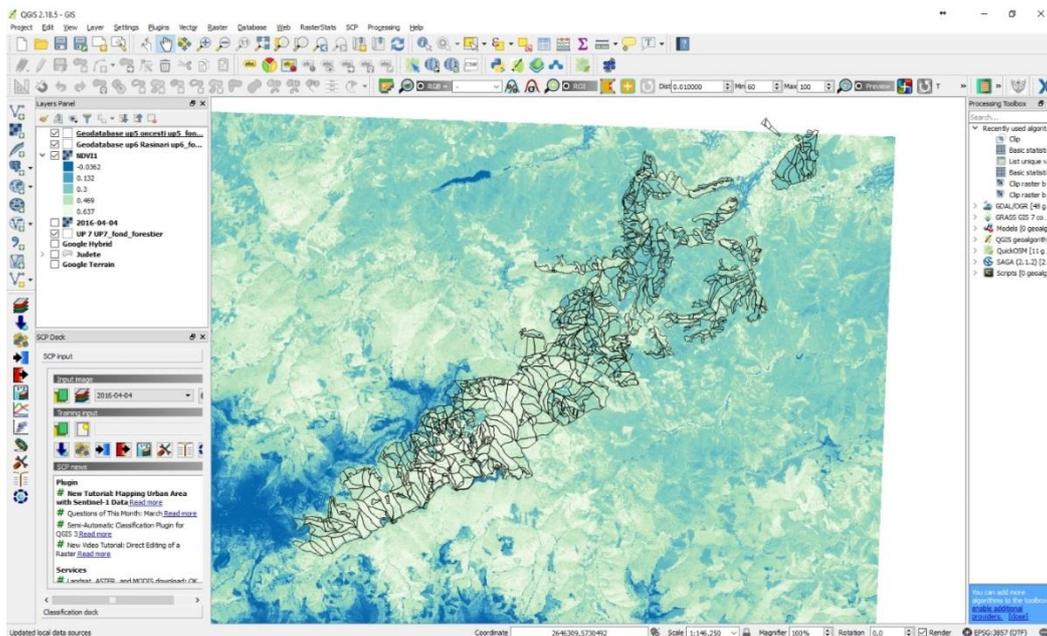


Fig. 6. Determination of NDVI

CONCLUSIONS

All images can be downloading free of charge from geodatabases available from USGS (Landsat-8), NASA (ASTER), ESA (Sentinel-2, WorldView-2). Especially attention should be paid on Sentinel mission, which follows up missions: ERS, ENVISAT, SPOT, Landsat, ASTER [7]. Comparison of the images of different spectral and spatial resolution registered in the same time is a rich source of information, particularly for environmental agency [3].

The use of GIS solutions is applicable in both forestry and agriculture. Analyzing high-resolution satellite imagery at short intervals can lead to considerable results, with multiple opportunities for adopting the most judicious measures.

Using GIS gives high accuracy in applying safety management plans. As was shown, GIS provides solutions to complex analysis on the managerial level through technical solutions provided by management plans and measures taken in the past. Forest dynamics is captured in an objective, real-time, and the use of aerial photographs and satellite images offers a true picture of the impact of technical solutions adopted.

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PERFORMANCE OBTAINED IN THE GROWTH OF MEAT CHICKENS IN PRIVATE HOUSEHOLDS

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Abstract

The paper presents the productive performances achieved in the breeding of broilers in the households of the population. Thus, for ROSS 308 hybrids raised in a semi-intensive system up to 80 days of age, a live weight of 2.5 kg / head at sacrifice, a 1.8 kg/carcass was achieved. The slaughter yield was 72, 77 %. Of the total carcass chest and legs accounted for 38.09 %. The average daily gain during the 80 days of growth was 30.75 g /had /day.

In the case of combined fodder up to 28 days and then with a mixture of concentrates, the total feed consumption for 55 chickens was 470 kg, resulting in a Feed Conversion Ratio (FCR) of 3.48.

Key words: meat chickens, semi-intensive system, feed conversion ratio

INTRODUCTION

At EU level in 2014, the countries with the largest poultry flocks were Poland, France, the United Kingdom and Germany, holding together approx. 50% of total flocks (Figure 1).

The poultry meat industry is comprised of the broiler and turkey industries. [15]

Growing broiler chickens is a complex activity and competition is fierce at EU level, and even in Romania. The progress of genetics and the enhancement of intensive technologies allowed for a shortening of the period of intensive exploitation to approx. 30 days. Breeding broilers is aimed at obtaining meat in a short time and with maximum economic efficiency. [8]

The demographic explosion, the substantial enrichment of the knowledge about rational human nutrition, as well as other socio-economic considerations, have led to increased breeding of broilers. The production technologies developed determined the exteriorization of production capacities. [1, 4, 6]

According with FAO definition family poultry is described like small-scale farm which raise chickens or hens, keeping by households. This little farm use family labour and locally feed resources. The poultry may range in different systems (intensive, semi-intensive

or extensive way) different birds. The birds can find a part of their food from local food resources.

In our country a little poultry is defined as a farm of less than 100 birds, of different breed, exploited in different farming systems. [5] Some authors described family poultry as “small flocks managed by individual farm families in order to obtain food security, income and gainful employment for women and children”. [2]

Family poultry is distinct from industrial poultry farms. Poultry can play an important economic and socio-cultural role in local communities. Family poultry uses family labour, from which women have an important role in the development poultry production. [14]

The meat chicken is a remarkable practice result of genetics and nutrition, which has been materialized thanks to post-war science and technology.

The main purpose of raising broilers in households is cost-effectiveness, with a minimum of investment and spending.

Small breeders have begun to abandon traditional extensive breeding and have gone to semi-intensive and intensive exploitation. The aim in this transition was to raise the productive potential of the chicken. This was made possible by a considerable improvement in the technological conditions of operation. [7]

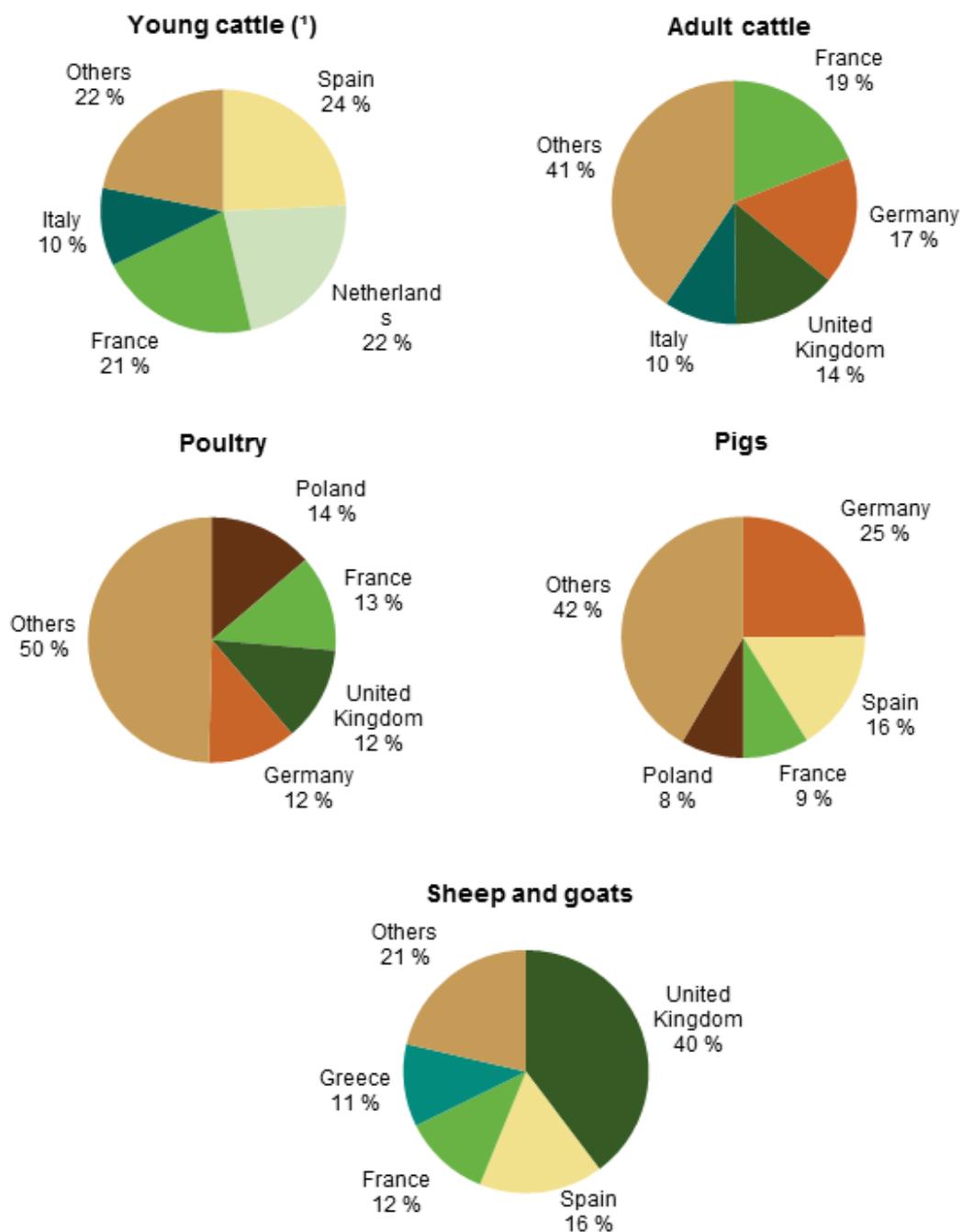
At the moment, in our country, there are three hybrids used in poultry industry: Cobb 500, Ross 308 and Hubbard Flex. Usually, these hybrids raised in industrial systems have appropriate productive performances. [3]

The Ross 308 hybrid has been created for a great percentage of their chests and legs from the total weight of carcasses. The hybrid has a better resistance to the microclimate and requires very good feed to gain performance. [16] The Ross 308 is a combination Plymouth Rocks and Cornish X.[17]

MATERIALS AND METHODS

The appreciation of the productive performance of ROSS 308 broiler chickens was achieved by tracking a consignment of 55 broilers. The chickens were reared between June 15 and September 3, 2016.

During the growth period, the daily average gain, body weight, feed consumption, specific feed consumption /kg of spores and mortality losses were monitored.



(*) Including calves.

Figure 1 Countries with the largest effectives of animals and birds at UE level, 2014 [9]

After scarification of the chickens, the slaughter yield, the average carcass weight and the percentage of the main parts of the carcass were determined.

The biological material used came from purchase at the age of 1 days from authorized companies. The technology of growth has been respected, following the principle of

"everything full- everything completely empty". Population density was 11 head /m² (27.5 kg /m² at slaughter). The growth period was 80 days.

The chickens were raised on the soil on permanent litter bed, under semi-intensive conditions, in the household. The shelter used was one made of brick, fitted with a door and a window that allowed the protection of rodents.

Feeding was done with combined fodder until the age of 28, after which it was gradually replaced with a mixture of concentrates purchased from farmers. Ingredients of corn, wheat, barley and sunflower were added to the mixture.

Also, we have been calculated one indicators by using the formulas:

$$\text{Feed Conversion Ratio (FCR)} = \frac{\text{Total Feed Consumed}}{\text{Total Live Weight}}$$

This indicator show the measure in which is converting the feed consumed into live body weight. It is important for broilers to have good FCR because they are often processed at a targeted live weight. [18]

RESULTS AND DISCUSSION

The 55 chickens were purchased on 15.06.2016, the increase being made until 03.09.2016. The mean weight at 1 day of age was 40 g /head, and the mortality was 0.01%. The average weight at slaughter was 2.5 kg /head, and the carcass weight was 1.8 kg. In order to determine the total increase in growth and the average daily gain, periodic weighing of a 12-head batch were performed. Productive performance recorded during growth is shown in table 1.

The chickens were raised on the soil on straw bedding. A good litter should provide: bird comfort and birds health. Also, it be biodegradable. [12, 13]

We tried to respect the rules published in the Directive 2007/43/EC. In this are presented minimum standards of protection and welfare of chickens for meat production. [10] Within the European Union, stocking densities are based on the EU Broiler Welfare Directive (2007): [18] • 33 kg/m² or • 39 kg/m² if stricter standards are met or • 42 kg/m² if exceptionally high welfare standards are met over a longer period of time.

The ROSS 308 hybrid manufacturer's guide shows that at the age of 21, males have to reach a weight of 959 g/cap, and females weigh 899 g/cap. [11, 13]



Foto 1 - ROSS 308 hybrid at age of 14 days



Foto 2 - ROSS 308 hybrid at age of 21 days

The average weight reached at the age of 21 days of chickens reared in the analyzed household was 855 g /head, close to that indicated by the hybrid producer (907 g /head). The average weight at 35 days was 1.402 kg. At the age of 42, the average weight /head reached 1,712 kg and at the age of 56 days, 1,997 kg. The slaughter was done when the chickens exceeded the average weight of 2.5 kg /head and had an average age of about 80 days. The average daily gain during the 80 days of growth was 30.75 g /had /day.

The chick weights at 35, 42, and 56 days of age were no longer consistent with the manufacturer's performance. The weight at the age of 56 was half the weight recommended by the manufacturer (1.997 kg /head versus 4.061 kg /head). The difference in weight is given by farm-based feed from the age of 29 days to slaughter. The farm mix haven't the protein level required for this hybrid.

Romanian companies who sell to small breeders this hybrid recommends slaughter at the age of 70 days, when the chicken should reach the average weight of 4.585 kg / head, both sexes. [16]

The slaughter yield was 72.77%, resulting in carcasses that averaged 1.8 kg. The share of main parts of the carcass at a live weight of 2.5 kg / head at the time of slaughter was: chest - 22.03%, and legs - 16.08% (38.09% of the total carcass).



Foto 3 - ROSS 308 hybrid at age of 28 days



Foto 4 - ROSS 308 hybrid at age of 80 days

Table 1

**Average weight / head, total increase in growth and daily average gain in chickens
reared in semi-intensive system***

Chikens age – 21 days			Chikens age – 35 days			Chikens age – 42 days			Chikens age – 56 days		
Average weight / head (g)	Total growth increase (g)	Daily average gain (g)	Average weight / head (g)	Total growth increase (g)	Daily average gain (g)	Average weight / head (g)	Total growth increase (g)	Daily average gain (g)	Average weight / head (g)	Total growth increase (g)	Daily average gain (g)
750	710	33.81	1.585	1.545	44.14	1.930	1.890	45.00	2.115	2.075	37.05
895	855	40.71	1.580	1.540	44.00	1.730	1.690	40.24	2.035	1.995	35.63
910	870	41.43	1.305	1.265	36.14	1.530	1.490	35.48	1.910	1.870	33.39
1.065	1.025	49.00	1.620	1.580	45.14	2.020	1.980	47.14	2.290	2.240	40.00
825	785	37.38	1.400	1.360	38.86	1.680	1.640	39.05	1.925	1.885	33.66
945	905	43.10	1.355	1.315	37.57	1.650	1.610	38.33	1.930	1.790	31.96
790	750	35.71	1.450	1.410	40.29	1.740	1.700	40.48	2.060	2.200	39.29
890	850	40.48	1.295	1.255	35.86	1.710	1.670	39.76	1.950	1.910	34.11
850	810	38.57	1.360	1.320	37.71	1.910	1.870	44.52	2.160	2.120	37.86
755	715	34.05	1.275	1.235	35.29	1.420	1.380	32.86	1.835	1.795	32.05
795	755	35.95	1.340	1.300	37.14	1.680	1.640	39.05	1.835	1.795	32.05
745	705	33.57	1.270	1.230	35.14	1.540	1.500	35.71	1.920	1.880	33.57
Average weight / control lot- kg		9.151	Average weight / control lot- kg		16.835	Average weight / control lot- kg		20.540	Average weight / control lot- kg		23.95
Average weight g/head-		762	Average weight g/head-		1.402	Average weight g/head-		1.712	Average weight g/head-		1,997

*Own calculation using the registered data from weighing

Total feed consumption was 125 kg of mixed fodder and 345 kg of concentrated mixture (corn, wheat, barley and sunflower). The specific consumption was 3.48 kg of feed /kg live, while the firms which selling the hybrid specified a consumption of 1.791 kg of feed /kg live at a weight of the chickens of 2.5 kg /head. [16]

The production costs were 2.5 lei /head for the purchase of day-old chicks, the combined fodder was bought at the price of 2.6 lei /kg (125 kg) and the concentrated mixture cost 1.16 lei /kg (345 kg). For 55 chicken costs related to the purchase of day-old chicks and

fodder used amounted to 863 lei. These costs did not include water, electricity (infrared lamp used up to 21 days) and labor.

CONCLUSIONS

The productive performance recorded in semi-intensive breeding of broilers allowed an average weight / head to be reached at the slaughter age (80 days) of approx. 2.5 kg / head and 1.8 kg /carcass.

The result for the calculated indicator Feed Conversion Ratio (FCR) was 3.48, which is very high.

The presented data shows that a chicken meat with a live weight of approx. 2.5 kg and with 1.8 kg/carcass, costs 16.70 lei. The initial investment is not too large and was amortized by increasing the analysed series of chicken. This show economic efficiency of an 55 chicken meat series (1 chicken was mortality) in a household. If we consider that a chicken meat at a carcass weight of 1.8 kilograms, it can sell at a price about 18 lei /kg, results a net income of 1750 lei. The net income resulted/chicken is 16.42 lei in a production cycle. The production cycle in this case was 14 weeks, from which 11 weeks are production and 3 weeks are veterinary vacuum.

For this chicken series (55 heads) we obtained 1750 lei income and we spent 863 lei, resulting is a net profit of 887 lei. Raising broiler chickens in small flocks can bring additional income for the private household.

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COMPLEXATION OF CADMIUM ON GOETHITE SURFACE

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Abstract

Cadmium(II)ion adsorption, mobility and surface complexation shows large pH dependence. The amount of sorbed metal ion increased with increasing pH but considerable cadmium(II)ion adsorption was found at the range 3,5<pH>7,0. Higher cadmium(II)ion adsorption could be detected in presence of organic acids than without it. Using the same metal ion and organic acid concentration higher cadmium(II)ion adsorption was found in presence of citric than malonic acid.

Key words: cadmium transfer, cadmium adsorption

INTRODUCTION

The key factors controlling the extent of cadmium transfer to food chain is the ability of soils to retain and release this metal. Cadmium adsorption varies among soil types depends on factors such as the chemical and mineralogical characteristics of the soils and the composition of the solution. These include pH, cation exchange capacity, organic matter, soil texture, ionic strength and iron and aluminium oxides (Boekhold et al 1993, White and Chaney 1980, Cowan et al 1991).

Organic matters of soils plays a very important role in determining soil quality, both from the point of view of soil fertility as well as of eco-toxicology. The bioavailability and transport of contaminants and nutrients is largely affected by presence of natural organic matter. These organic matters strongly bind contaminants and cationic nutrients and the solubility of organic materials largely determine the migration behavior of contaminants. Natural organic acids consist of a mixture of well- and ill-defined organic acids, the structure and chemical behavior of the ill defined organic acids is very complex. The functional groups of ill-defined large organic molecules (carboxylic and phenolic groups) can also be found in smaller, well-defined organic acids. It was found that there are important similarities in sorption and complexation mechanism of humic substances and simple weak organic acids (Gu et al 1994).

In this paper we will study the mobility of cadmium in the cadmium - small weak organic acid - goethite system. The small weak organic acids (such as citric- and malonic acid) was chosen as a model compound for larger organic acids like fulvate and humate.

MATERIALS AND METHODS

Preparation of goethite

Goethite were prepared by titrating 5L of 0.5 M $\text{Fe}(\text{NO}_3)_3 \cdot 9\text{H}_2\text{O}$ with 2.5 M NaOH at a rate 9 ml min^{-1} to a of 12. The suspension was aged for 4 days at 60°C and subsequently dialyzed with distilled demineralized (DD) water (Hiemstra et al 1989). The specific surface areas of the goethite were determined by BET_{N₂} adsorption (Hiemstra and Riemsdijk 1996).

Adsorption experiments

The sorption of Cd^{2+} and small week organic acids was examined (such as citric acid and malonic acid) in a single sorption and competition experiments.

All measurements were carried out as batch experiment in a 20 ml plastic bottle at constant temperature (20°C) in 0.1 mol/l NaNO_3 . Experiments were set up by adding fixed amount of goethite (12 g/l) and organic acid stock solution (2 mmol/l). The Cd^{2+} -ion concentration of samples were 0.05, 0.20 or 0.80 mmol/l. The pH ranged from 3.0 to 7.5 (differences in pH were obtained by adding small volume of 0.1 mol/l NaOH or 0.1 mol/l HNO_3). All solution were prepared with DD water.

After 24 hours shaking the samples were centrifuged at 20,000 g. The pH, cadmium(II)ion concentration (ICP) and organic acid concentration (total organic carbon analyzer) was measured in the supernatant.

Sorbed Cd^{2+} and organic acid amounts were calculated from the differences of total and supernatant concentrations.

Modeling Adsorption

The adsorption of weak organic acids and Cd is analyzed using the CD-MUSIC model (Hiemstra and Van Riemsdijk, 1996). The parameter values for the CD-MUSIC model are obtained from experimental data. The choice of the site densities of the surface groups is discussed in Venema et al. (1996). From the description of the primary charging behavior of the goethite the parameter values for the PZC, capacitance, and ion pair formation constants are obtained. Table 2 shows the parameter values used to describe the basic charging behavior of the goethite.

RESULTS

Adsorption isotherms

Cadmium(II)ion adsorption shows large pH dependence. The adsorption isotherms are shown on Figure 1. The amount of sorbed metal ions - according to experimental data - increase with increasing pH. Considerable cadmium(II)ion adsorption was found at the range $3.5 < \text{pH}$.

Higher Cd(II) ion adsorption could be detected in presence of organic acids than without the ligand. Using the same metal ion and organic acid concentration higher Cd(II) ion adsorption was found in presence of citric than malonic acid.

The adsorption isotherms of citric and malonic acid are shown on Figure 2. Organic acid adsorption also shows pH dependence (Filius et al, 1997). The amount of sorbed organic anion decreases with increasing of pH. At the same pH and organic acid concentration the citric acid adsorption was found higher than malonic acid. This result agreed well was found earlier by Filius et al (1997).

Modeling Sorption Data

To describe well the reactions it was necessary to define the surface characteristics of goethite and the physicochemical parameters of surface species. These parameters were given by Venema et al (1997) and Hiemstra and Riemsdijk (1996). The pH dependence of surface groups of Fe(III)-hydroxides was determined the charging behavior of goethite. According to morphological and crystallographic analysis 110 and 021 crystal faces was present in our goethite preparation but the first (110) plane was dominant (Hiemstra and Riemsdijk 1996, Venema et al 1996). The distribution of two planes were 90% and 10%. The chemical composition of the two kinds of faces was found different. On the surface different surface oxygen groups such as singly ($\text{FeOH}^{-1/2}$), doubly (Fe_2OH^0) and triply ($\text{Fe}_3\text{O}^{-1/2}$) coordinated surface oxygen could be determined (Hiemstra and Riemsdijk 1996, Venema et al 1996).

The surface charge of 110 face was determined by the protonation reactions of singly and triply coordinated surface oxygen. The reactions of singly coordinated surface oxygen groups of $\text{FeOH}^{-1/2}$ (site density= 3.0 site/nm^2) is more express than the triply coordinated $\text{Fe}_3\text{O}^{-1/2}$ one because of occupied orbitals of the oxygen (site density= 3.0 site/nm^2) (Hiemstra et al 1989, Venema 1997).

On 021 face the singly (site density= 7.5 site/nm^2) and doubly coordinated (site density= 3.75 site/nm^2) surface groups alternate. The protonation reaction of doubly

coordinated surface group (Fe_2OH^0) was unimportant at normal pH range (Hiemstra 1989). Venema et al (1996) described surface particles and their formation constants in case of adsorption of cadmium(II)ion on goethite (Table 3). Filius et al (1997) characterized the surface particles both in citric or malonic acid and goethite system. Surface particles and model parameters are shown in Table 2. This work be accepted as preliminary modeled data of surface particles and their constants of single-sorbate systems. These model calculations fit well with our experimental data (see Figure 1 and Figure 2).

To describe well the adsorption data by model it was necessary to suppose more kinds of interactions than single system. Therefore supposed interactions between the surface - organic acid complexes and metal ion and between the surface and metal - organic acid complexes. Table 4. shows these surface species and their parameters in modeling of binary system.

Citric acid and cadmium system

As Figure 1.a shows in citric acid-cadmium(II)-goethite system considerable Cd(II) adsorption was found above $3.5 < \text{pH}$. Model calculations gave evidences (see Figure 4) at range $\text{pH} < 4.5$ the Fe_2CitCd (see Fig. 3) was present as cadmium(II) ion containing inner sphere surface complex. Increasing the pH to 4.5 the monodentate surface cadmium complex $(\text{FeOH})\text{Cd}$ (see Table 1), $(\text{FeOH})_2\text{CdCit}$ and $(\text{FeOH})\text{Cd}$ surface complexes (see Fig 3, Table 3) (6) appeared. $\text{pH} < 5.5$ the Fe_2CitCd was the dominant species (see Fig. 4). From $\text{pH} \approx 5.5$ five different cadmium containing surface species was present (Fe_2CitCd , $(\text{FeOH})\text{Cd}$, $(\text{FeOH})_2\text{Cd}$, $(\text{FeOH})_2\text{CdCit}$ and $(\text{FeOH})\text{CdCit}$). The Fe_2CitCd decreases sharply with increasing pH. The monodentate surface cadmium complex $[(\text{FeOH})\text{Cd}]$ and the bidentate surface complex $[(\text{FeOH})_2\text{Cd}]$ (see Table 1) was the same as found in the single cadmium(II) goethite system (3). The $(\text{FeOH})_2\text{CdCit}$ and the $(\text{FeOH})\text{CdCit}$ was outer sphere surface complexes (see Fig. 3 and Table 3). The amount of the last four species increased with increasing pH to 6.0-7.0 (see Fig.4). Above $\text{pH} \approx 6.5$ the amount of Fe_2CitCd species was negligible.

According to the adsorption isotherms the quantity of Cd(II)ion increased with increasing pH (see Fig. 1.a). Model calculations showed that (see Fig. 4) the surface complexation of cadmium(II)ion sharply decreased above $\text{pH} = 6.5 - 7.0$ (depending on the total concentration of Cd(II) ion). Really the increase in the sum of amount of sorbed Cd(II)ion (see Figure 1.a) was because of formation of CdCO_3 precipitate at the $7.0 < \text{pH}$ range. So sorption of cadmium on surface of goethite was important in the $3.5 < \text{pH} < 7.0$ range.

Malonic acid and cadmium system

As Figure 1.b. shows in malonic acid-cadmium(II)-goethite system considerable Cd(II) adsorption was found 3.0<pH range. According to model calculations (see Fig. 5) below pH≈4.0 the Fe₂MalCdMal (see Fig. 3 and Table 3) was the main cadmium ion containing surface complex. Increasing the pH≈4.0 five different Cd(II) containing surface species was could be present. The Fe₂MalCdMal species, a monodentate surface cadmium complex [(FeOH)Cd], a bidentate surface complex [(FeOH)₂Cd] and two outer sphere surface complexes. These were (FeOH)₂CdMal (see Fig. 3, Table 3) as and (FeOH)CdMal (see Table 3). The concentration of Fe₂MalCdMal species increases with increasing the pH to 6.5. Above this value the species was unimportant (see Fig. 5). The maximum value of (FeOH)CdMal species was found at pH≈6.0. The same of (FeOH)₂CdMal species was at pH≈6.5-7.0 (depending of metal ion concentration). In spite of the fact that adsorption isotherms (see Figure 1.b) of cadmium(II) increased the quantity of the sorbed cadmium ion decreased (see citrate) Really from pH=6.0 -7.0 range (depending of metal ion concentration) CdCO₃ precipitate formed. So sorption of cadmium (in presence of malonate) on goethite was important really the 3.0<pH<7.0 range.

From model calculation was visible: if the pH was far enough from pH of ZPC inner sphere complexation happened. Increasing pH the surface charge decreased and outer sphere complex formed instead of inner sphere complex.

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Table 1 Surface Species Used in Modelling of Adsorption of Cadmium(II) ion on Goethite (Venema, 1996)

Crystal face	Species	Log K	FeOH	Fe ₃ O	Fe ₂ OH	H	Cd	Δz ₀	Δz ₁	Δz ₂
110	(FeOH)Cd	5.50	1	0	-	0	1	0.30	1.70	0.00
	(FeOH) ₂ Cd	6.90	2	0	-	0	1	0.60	1.40	0.00
021	(FeOH) ₂ Fe ₂ OHCd	9.00	2	-	1	0	1	1.16	0.84	0.00

Table 2 The parameter values used to describe the basic charging behaviour of the goethite (Hiemstra et al 1989)

A:	94 m ² /g
C ₁ :	1.1 F/m ²
C ₂ :	5 F/m ²
N _s (FeOH):	3.45 sites/nm ²
N _s (Fe ₃ O):	2.7 sites/nm ²
PPZC:	9.2
log K _{Na+}	-1
log K _{NO3-}	-1

Table 3 Surface Species Used in Modeling of Adsorption of Organic Acids on Goethite (Filius, 1997)

Organic anion	Species	Log K	FeOH	H	Organic anion	Cd	Na	Δz ₀	Δz ₁	Δz ₂
citrate	Fe ₃ CitH	29.75	3	3	1	0	0	1.80	-0.80	-1.00
	Fe ₃ CitH-H	34.40	3	4	1	0	0	1.80	-0.30	-0.50
	Fe ₃ CitH-Na	31.00	3	3	1	0	1	1.80	-0.80	0.00
	Fe ₃ Cit-Na	23.90	3	2	1	0	1	1.80	-0.80	-1.00
	Fe ₄ CitH	39.80	4	4	1	0	0	2.60	-0.60	-1.00
malonate	Fe ₂ Mal	17.80	2	2	1	0	0	1.00	0.00	-1.00
	Fe ₃ Mal	26.70	3	3	1	0	0	1.80	-0.30	-0.50
	Fe ₂ Mal-Na	19.80	2	2	1	0	1	1.00	0.00	0.00

Table 4 Surface Species Used in Modeling of Adsorption of Organic Acids and Cadmium (II) ion on Goethite

Organic anion	Species	Log K	FeOH	H	Organic anion	Cd	Na	Δz ₀	Δz ₁	Δz ₂
citrate	Fe ₂ CitCd	24.80	2	2	1	1	0	1.00	0.00	0.00
	(FeOH) ₂ CdCit	11.75	2	0	1	1	0	0.60	-0.60	-1.00
	(FeOH)CdCit	9.50	1	0	1	1	0	0.30	-0.30	-1.00
malonate	Fe ₂ MalCdMal	21.10	2	2	2	1	0	1.00	-1.00	0.00
	(FeOH) ₂ CdMal	8.20	2	0	1	1	0	0.60	-0.60	0.00
	(FeOH)CdMal	6.20	1	0	1	1	0	0.30	-0.30	0.00

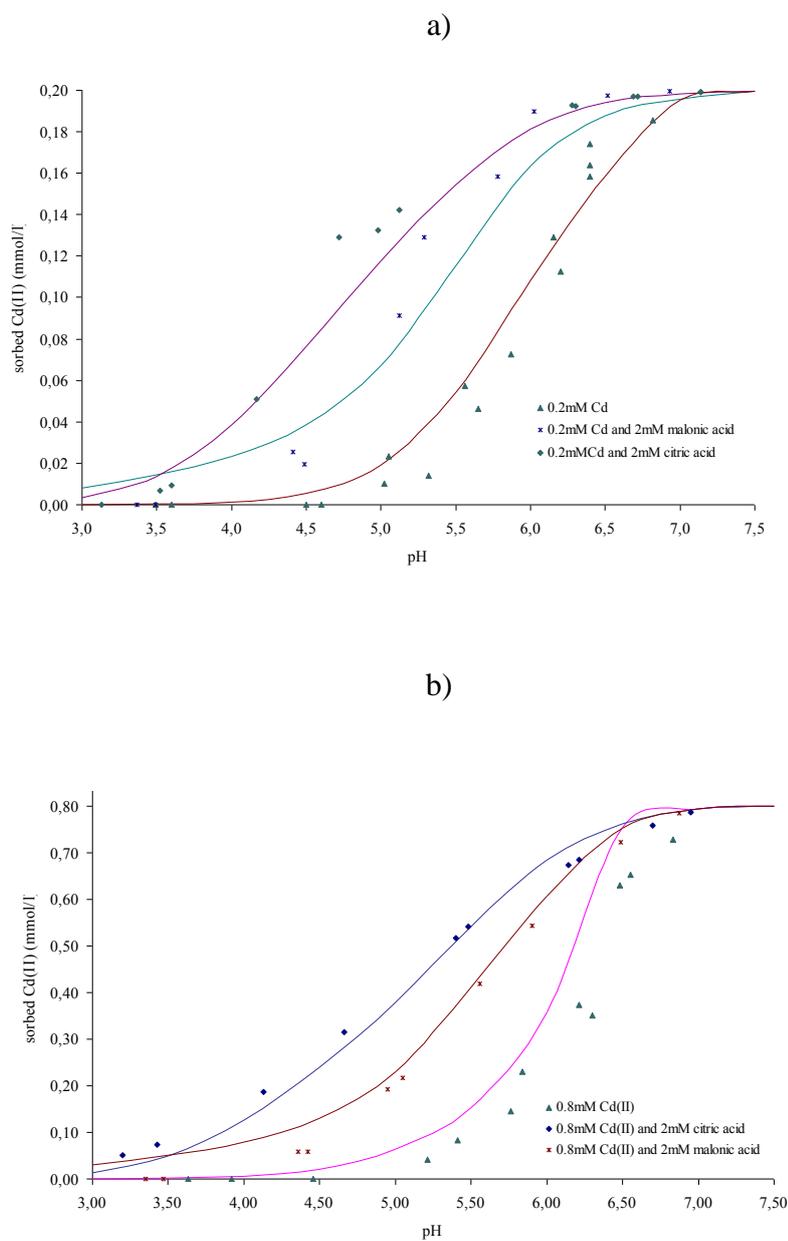


Figure 1 Adsorption isotherms of cadmium(II) ion
(marks are measured and lines are model data)

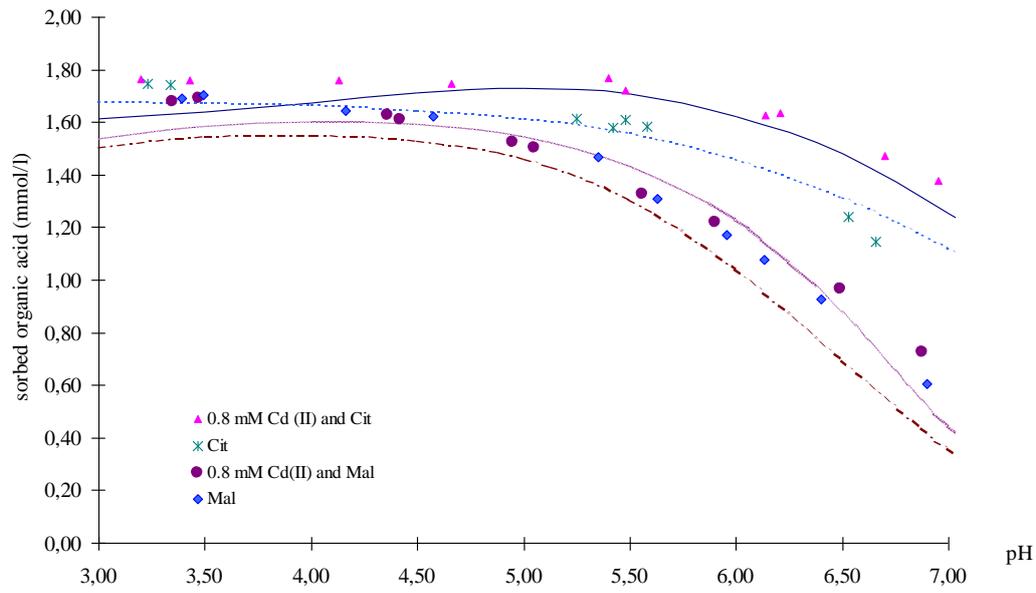


Figure 2. Adsorption isotherms of organic acids
(marks are mesured and lines are model data)

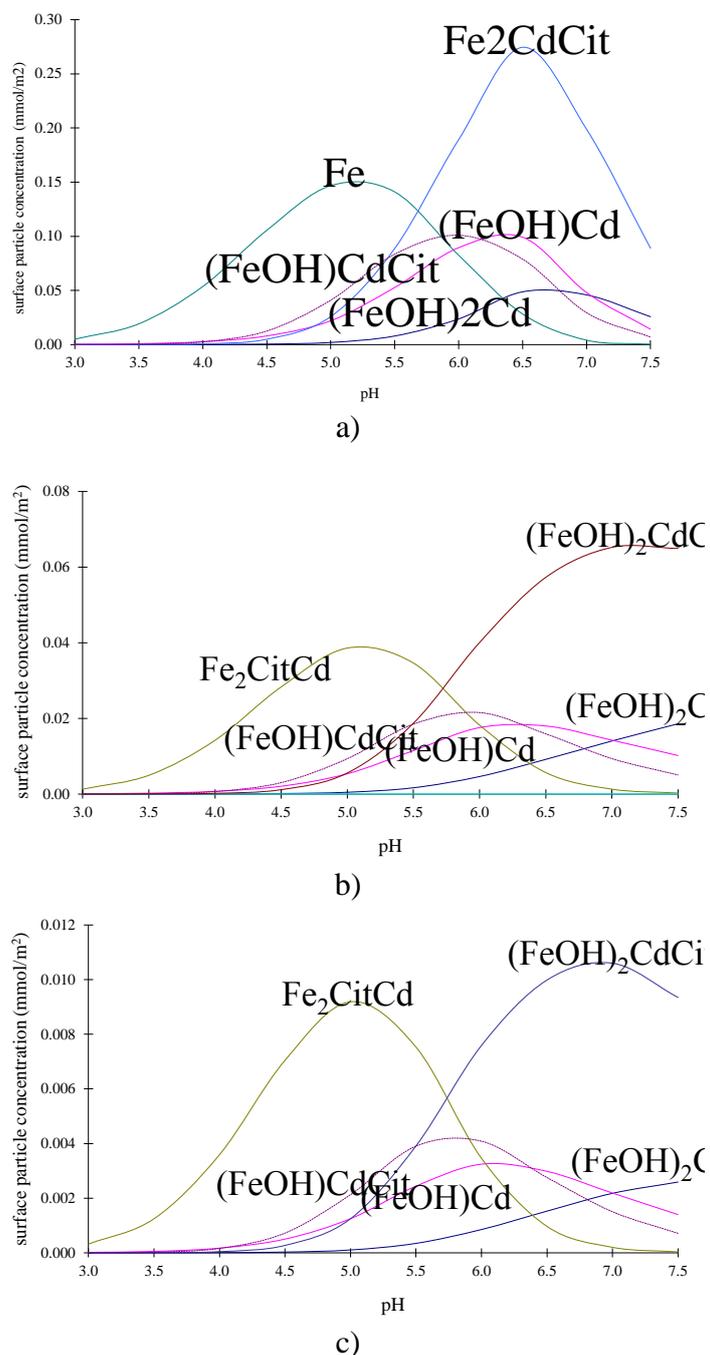


Figure 4. Surface particle concentration in Cd(NO₃)₂ and 2mM/dm³ citric acid (a=0.8 mM/dm³; b=0.2 mM/dm³; c=0.05 mM/dm³)

COMPARATIVE STUDY ON EMISSIONS RELEASED BY A DIESEL ENGINE FUELED WITH BIODIESEL AND ONE WITH CONVENTIONAL FUELS

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Abstract:

The paper presents some studies made on a diesel engine which was fueled both with oil and biodiesel and the results obtained concerning the emissions released by the engine in both cases and also the changes that appear on different parts of the engine while using biodiesel.

Key words: emissions, biodiesel, conventional fuels

INTRODUCTION

It is a well known fact that the engines fueled with conventional fuels release in atmosphere many emissions, which damage the environment and are harmful for human health. Thus, the burnt gases released by the Diesel engines contain the following elements: carbon monoxide (CO), carbon dioxide (CO₂), hydrocarbons, Oxygen, (O₂), water (H₂O), sulphur oxides (SO_x), Nitrogen oxides (NO_x), Carbon (C).

Some components, such as the gaseous ones, can be measured with a gas analyser. But, in order to measure the quantity of carbon from the released gases, an opacity-meter will be used. The higher opacity is, the higher is the quantity of carbon in the burned gases.

MATERIALS AND METHODS

The experiments were made using an opacity-meter model VLT 4590, which is a high precision device, assisted by a microprocessor, which allows obtaining of quick and precise readings of smoke opacity. The determinations were made with the opacity-meter through free acceleration between slow rotation of idling engine and the maximum rotation of idling engine at a normal thermal regime of engine.

The following environment conditions will be respected: temperature 5- 30°C and atmosphere pressure 945 – 1025 m bars.

Before the measurements, the cleaning of the evacuation system is made, through acceleration at least one time until the maximum rotation of idling engine, which is maintained at least 2 seconds.

We made at least 3 measurements of opacity at free acceleration.

The obtained opacity index represents the arithmetic media of minimum 3 measurements of the opacity index in free acceleration, which respects the following conditions:

- The basic time for each measurement does not exceed the specified value
- Between the minimum rotations measured at each determination there are not significant differences
- Between the opacity index measured at each determination there are not differences bigger than 0,5 m-1

RESULTS AND DISCUSSIONS

After measuring the carbon emissions with opacity-meter VLT 4590, the following values were obtained for an engine fueled with conventional fuel and one fueled with biofuel containing up to 20 % biodiesel (B20) (Table 1).

Table 1. Comparative values of emissions opacity for engine

Slow idling rotation (min ⁻¹)	Maximum idling rotation (min ⁻¹)	Opacity value engine fueled with conventional oil k (m ⁻¹)	Opacity value engine fueled with biodiesel B 20 k (m ⁻¹)
830	5330	1,93	1,27
830	5450	2,02	1,23
830	5460	2,04	1,28
Medium value of opacity		2,00	1,26

Specific emissions resulted when using biodiesel

Carbon dioxide (CO₂): every tone of conventional Diesel fuel release aproximative 2,8 tones of CO₂ in atmosphere. The specific carbon content in a tone of biodiesel is slightly low, of aproximative 2,4 tons of CO₂.

The sulphur oxides (SO_x): In present, the Diesel conventional fuel contains 350 ppm sulphur. When this fuel is burnt, the sulphur is released in atmosphere in the form of sulphur oxides, leading to the acid rains. The Biodiesel fuel does not contain sulphur almost at all (0-0.0024 ppm). In European Union are promoted the fuels with a low content of sulphur, for example: under 50 ppm in England and under 10 ppm in Sueden.

Nitrogen oxides (NO_x): emissions of NO_x from biodiesel fuels can increase or decrease compared to fossil fuels, depending on the engine type. Emissions of NO_x from pure biodiesel decreases with aproximative 6% compared to conventional Diesel oil.

Carbon monoxide (CO): Biodiesel contains oxygen components, which improve the combustion process and decreases CO emissions with up to 20%.

Material particles: The material particles are proven to be very harmful for human health. After experiments, it was observed that emissions of material particles from biodiesel fuels is much lower (over 40%) compared to the emissions from the conventional Diesel fuels.

Bio-degrading: the conventional Diesel fuels degrade only in 50% proportion in the first 21 days after releasing, while the biodiesel fuels in 98% proportion harmless after the same period of time. It was realised that using a mixture fuel of 20% biodiesel reduces the risk of cancer up to 27%. In Table 2, B 20 is a mixture fuel which contains 20% biodiesel and 80% petrol oil. B100 is biodiesel 100 %.

Table 2. Reducing of pollutant emissions if using biodiesel fuels

Emissions in evacuation gases	Emissions, %		
	Petrol oil	B20	B100
Carbon monoxide	100	-12,6	-43,2
Unburnt hydrocarbons	100	-11	-56,3
Suspension powders	100	-18	-55,4
Nitrogen oxides	100	+1,2	+5,8
Air toxins	100	-12...-20	-60...-90
Mutagenic effects	100	-20	-80...-90
Sulphur oxides	100	-20	-100 (missing)
Sulphurates	100	-20	-100 (missing)

CONCLUSIONS

Wears which appear at diesel engines which use Biodiesel

After studying the effects which biodiesel has on some engine components it can be observed that some of them are negatively influenced. Thus, injectors, valves, cylinder heads, pistons and crankshaft have some deposits which negatively influence the engine functioning. But these influences can be easily removed by using some special additives. In fig. 1, 2 are shown the modifications on some engine parts when using biodiesel.

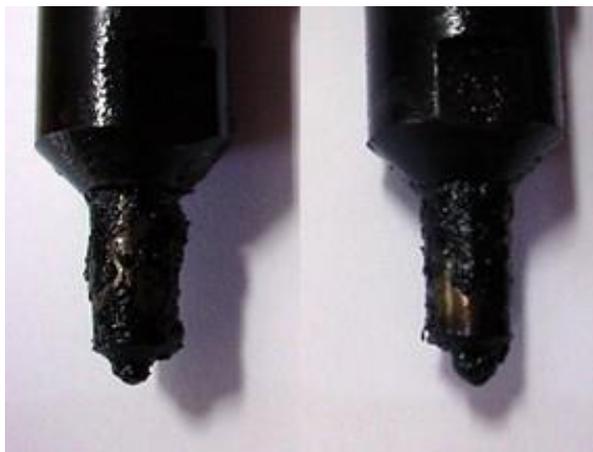


Fig. 1. Biodiesel influence on injectors



Fig. 2. Biodiesel influence on valves

From the above image it can be observed that on the injector body are deposited dark brown viscous resins. These resins are easily dissolved in petrol products, but more difficult in alcohol.

After experiments, it can be observed that the engine oil, in the case of using as fuel a mixture of petrol oil and 20 % biodiesel, assured a better lubrication of engine parts, the segments mobility, a minimum contamination of pistons and cylinders, a good cleaning of segments and injectors.

As a conclusion, we can say that biodiesel is a fuel which can be used in good conditions to engines and that it is a viable substitute for the conventional petrol oil.

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COLLAGEN BASED BIO-FUNCTIONAL PRODUCTS FOR PLANT TREATMENT

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Abstract

The use of mammalian or fish collagen in compounds for treating cereal or rape seeds is a less studied topic, although film-forming properties, organic nitrogen and free amino acid content, the ability to form complexes with micronutrients and the amphoteric nature provide smart nutritional properties and stimulate germination, allowing reduction of pesticide concentration or seed loss. The possibility of exploitation of elastic properties of gelatin and crosslinked gelatin in rape crop treatment represents an innovative route for versatile products based on a natural and biodegradable available resource. The technological schemes for collagen hydrolysate and gelatin extraction and refinery based on chemical-enzymatic hydrolyses are shown as a facile process for implementation in pilot scale production. The collagen additives were characterized from the point of view of molecular weight, particle size and distribution, free amino acid content, dry substance, organic nitrogen and ash content. Laboratory and field tests on barley, rye and rape seeds treated with collagen hydrolysate and crosslinked collagen showed improved crop indexes and the possibility to reduce the pesticide concentration.

Keywords: collagen, seeds, plant, biostimulant, pesticide.

INTRODUCTION

The compatibility of protein hydrolysate with many other chemical materials used in seed and plant treatment is due to the high miscibility in different solvents, adhesiveness, increased absorption at leaf level, biodegradability and opens a way for toxicity reduction and plant health stimulation. The specific amino acids of collagen, proline and hydroxyproline, act mainly as hydric balance of the plant strengthening the cellular walls in such a way that they increase resistance to unfavorable climatic conditions.

The use of insecticides from the neonicotinoid class has reached a global share of 17% in the context of proven hazardous and persistent toxic effects on bees, soil and the environment. According to recent studies [1], complex mixtures of insecticides, fungicides and fertilizers used for coating corn, soy, rape and wheat seeds amplify the toxicity of neonicotinoids as much as 1000 times, without contributing to the increase in plant

production. It is estimated that only 0.1% of pesticides used in crop protection act against pests, the rest of chemicals pollute the environment [2]. In this context, the use of growth biostimulants is an environmental alternative, and in the case of adding natural insecticides and fungicides, it may contribute to the reduction of synthetic pesticides. At present there are a series of fertilizers and biostimulants containing amino acids on the market, fostering increased plant production. The role of free amino acids in the plant metabolism is an important one,[3], and may stimulate the self-defense system of plants in the early stages of development, which would enable reduction of pesticides in the seed coating or plant treatment compositions. The valuable experience, already attested at semi-industrial scale, in protein extraction from chrome shaving wastes and formulation of NPK radicular fertilizers is an important step in the development of new applications for agriculture [4,5].

The use of mammalian or fish collagen in compounds for treating cereal or rape seeds is a less studied topic [6-9], although film-forming properties, organic nitrogen and free amino acid content, the ability to form complexes with micronutrients and the amphoteric nature provide smart nutritional properties and stimulate germination, allowing reduction of pesticide concentration or seed loss.

The paper presents the technological schemes for collagen based additives manufacturing, the characteristics of the new materials for agriculture use and the quality indexes recorded after laboratory and field tests for cereal seeds and rape crops.

MATERIALS AND METHODS

Materials:

The bovine shavings used as raw material showed the typical characteristics: moisture-51%, total ash-8.6%, total nitrogen-16.5%, pH of aqueous extract-4.2.

The fish skins from aquaculture origin were carp, sturgeon and trout with characteristics ranging as follows: moisture-57-69%, extractable matters-0.4-0.7%, total ash-0.5-11%, total nitrogen-10-17%.

The chemical products for collagen based extracts were of technical grade (NaOH, CH₃COOH, Ca(OH)₂, Alcalase 2.4L) and the crosslinking reagent was glyoxal solution of 40% concentration, analytical grade.

Methods for collagen extraction, crosslinking and characterisation:

Chemical and chemical-enzymatic hydrolysis were performed according to the Schemes 1 and 2 after a complex research for process optimisation and was developed at pilot level.

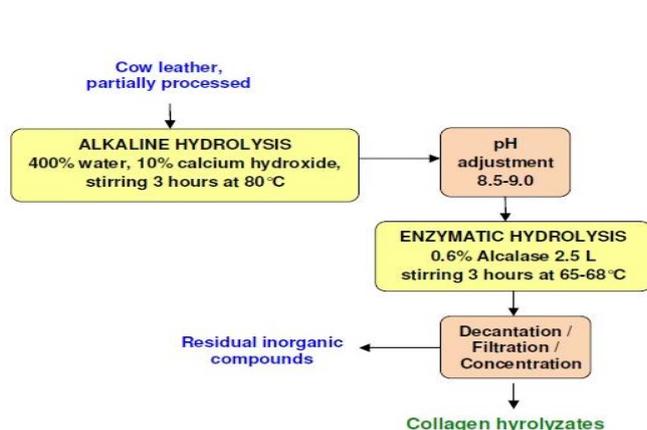
Fish gelatin extracts were crosslinked with glyoxal at pH of 7.2 to improve elastic and strength film properties needed for rape crop treatment. The reticulation of fish collagen was analysed by FTIR (Brucker Tensor 27).

Characterisation of collagen hydrolysate and gelatin was done for: dry substance (EN ISO 4684), nitrogen content (ISO 5397), aminic nitrogen (ICPI method) and free amino acid composition (EN ISO 13903). The particle size and distribution for collagen hydrolysates were determined by DLH (Dynamic Light Scattering) using Zeta-Sizer NanoZS (Malvern).

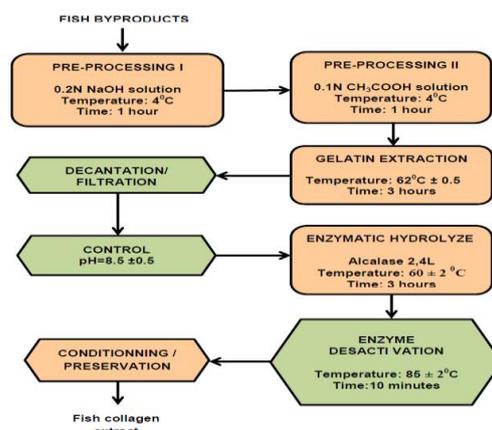
Methods for cereal seed and rape crop treatment with composites based on collagen extracts:

Field tests were performed for barley and rye seeds treated with mixtures of collagen hydrolysate and insecto-fungicide commercial products (Celest, Syngenta) with reduced concentration and in comparison with untreated and conventionally treated seeds. The resistance of treated seeds against *Fusarium culmorum* EC85, *Septorianodorum* E52, *Septoriatritici* E39, *Erysiphegraminis* E32, *Helmithosporiumtritici-repentis* E39 as well as the germination and germinative energy were assessed and presented here for efficient concentrations.

The influence of fish collagen hydrolysate and gelatin pH on rape seeds germination was assessed for values of 4,6,5 and 7. Field tests for Sammy rape crop treatment with fish collagen hydrolysate and crosslinked collagen hydrolysate as indehiscent products were experimented. The number of shaken seeds from 1 m² for ten repetitions of each kind of treatment and the rape seed production for ten parcels of 100 m² were assessed.



Scheme1-Bovine hide byproducts processing into collagen additive



Scheme 2-Fish byproducts processing into gelatin and collagen additive

RESULTS AND DISCUSSIONS

Collagen extracts characteristics

The free amino acid composition of collagen hydrolysates extracted from bovine by-products and fish skins showed slight differences in quantitative distribution (more proline in bovine collagen hydrolysate) and qualitative composition (more diverse amino acids in fish hydrolysates: aspartic acid, serine, tyrosine, leucine) as can be seen in Figures 1 and 2.

Chemical composition of collagen hydrolysates and gelatin is presented in Table 1 and proves the versatility of hydrolyse processes able to generate products with molecule weigh distribution from 4200 Da to 39200 Da and organic nitrogen concentration from 14.76% to 16.79%.

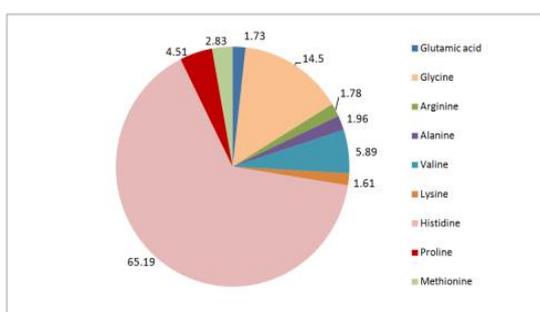


Fig.1-Free amino acid composition of collagen hydrolysate from bovine hides byproducts

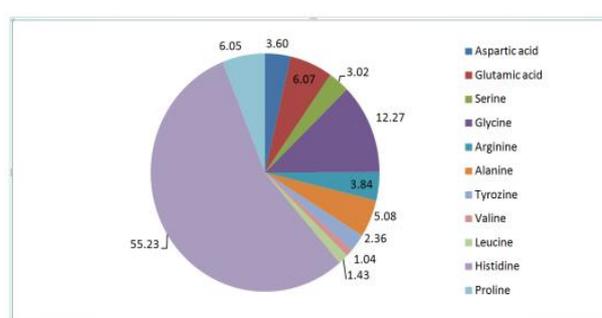


Fig.2-Free amino acid composition of collagen hydrolysate from fish skins byproducts

Table 1. Chemical composition of collagen hydrolysates and fish gelatin

Characteristics	Fish gelatin	Fish collagen hydrolysate	Bovine collagen hydrolysate
Dry substance, %	4.47	4.40	9.59
Total ash, %	0.67	4.09	7.09
Total nitrogen, %	14.76	14.77	16.79
Aminic nitrogen, %	0.32	0.99	1.55
MW (Sørensen method), Da	39200	13050	4200
pH	6.35	7.94	8.77

The polydispersity and particle size of collagen hydrolysates from bovine by-products and fish skins are presented in Figures 3 and 4 and appear to be composed of 3 kinds of particle populations with different share: between 10-100 nm (1.5-5.1%), 100-1000 nm (65.4-

76.4%) and 1000-10000 nm (22.1-29.5%). The particle size distribution showed higher concentration of low particles (5.1%) and large particle size populations (29.5%) in bovine hydrolysate and higher concentration of middle particle size in fish hydrolysate (76.4%). This distribution provides diverse nutrients from free amino acids and dipeptides (10-100 nm) to oligopeptides (100-1000 nm) and surface protection through polypeptides (1000-10000 nm) to seeds and plants.

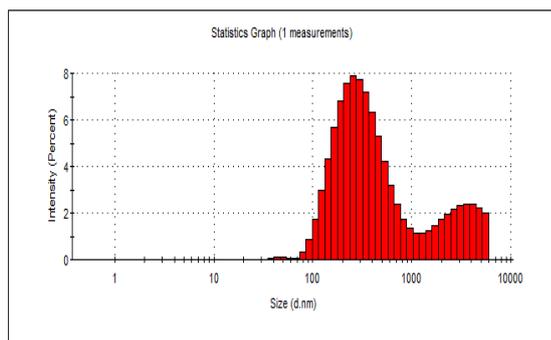


Fig.3- Size distribution of fish collagen particles

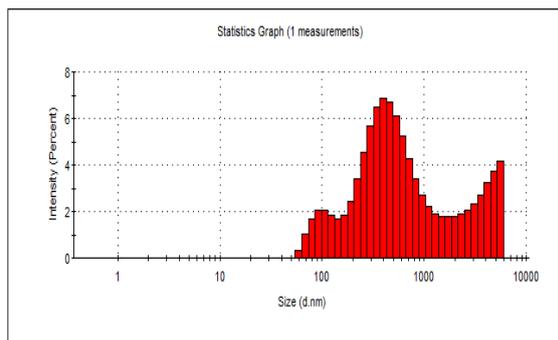


Fig.4- Size distribution of bovine collagen particles

The crosslinking of fish collagen with glyoxal was successful, as Figure 5 shows, where the new wavelengths are generated at 2923.61 cm^{-1} , 2823.61 cm^{-1} and 1916.76 cm^{-1} , confirming collagen polycondensation with glyoxal.

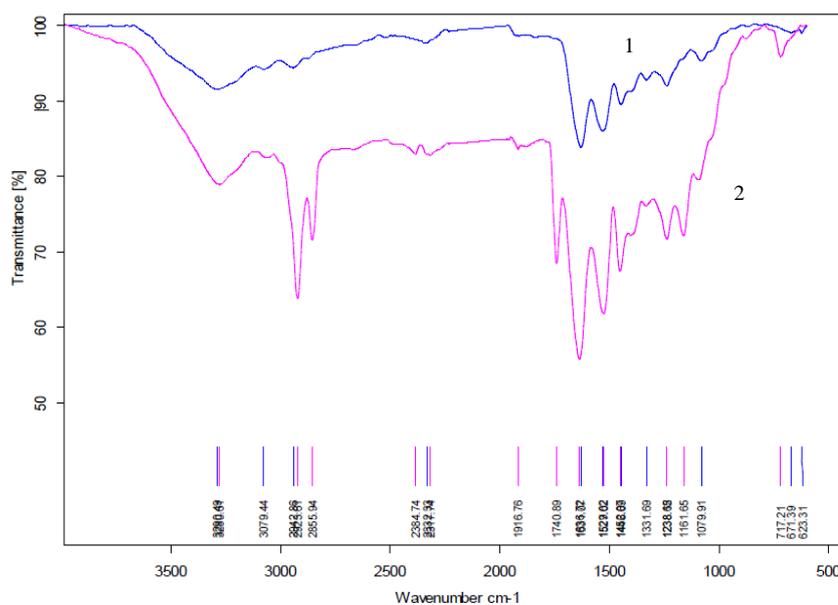


Fig.5- FTIR spectra of fish collagen hydrolysate (1) and crosslinked collagen hydrolysate (2)

Field test of bovine collagen hydrolysate on cereal plants

The experimental results on the resistance of treated seeds against specific fungus for cereal plants showed that the differences were not significant for treated seeds with collagen hydrolysate and reduced concentration of fungicide as compared with classical treatment with pesticide and were significantly different as compared to untreated seeds. In Figures 6 and 7 are presented the resistance of barley and rye seeds against *Fusarium culmorum* EC85, *Septorianodorum* E52, *Septoriatritici* E39, *Erysiphegraminis* E32, *Helmithosporiumtriticirepentis* E39.

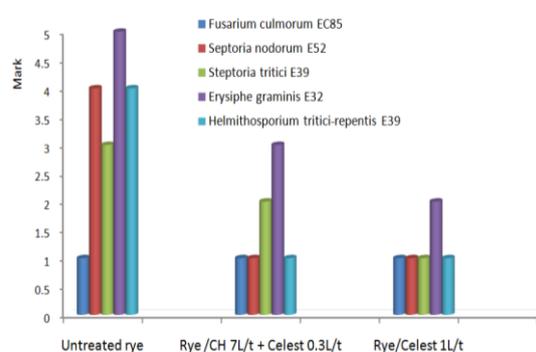
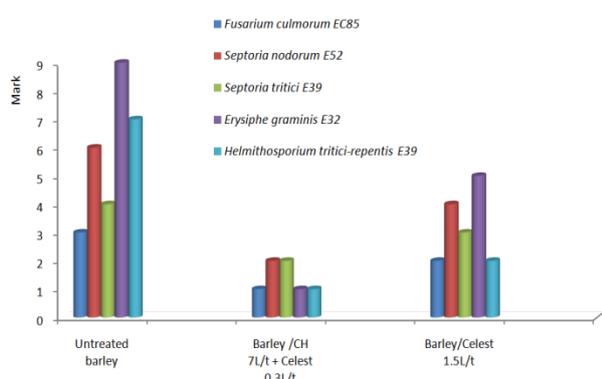


Fig. 6- Barley seeds resistance against fungus

Fig.7- Rye seeds resistance against fungus

The germination and germination energy were higher for barley and rye seeds treated with collagen hydrolysate and reduced pesticide (Figure 8). In spring the tillering of experimented cereals treated with collagen hydrolysate was higher (barley) or similar with classical treated plants. The results showed that the reduction of fungicide concentration can be used due to the positive influence of collagen hydrolysate on self-defense system of the plant.

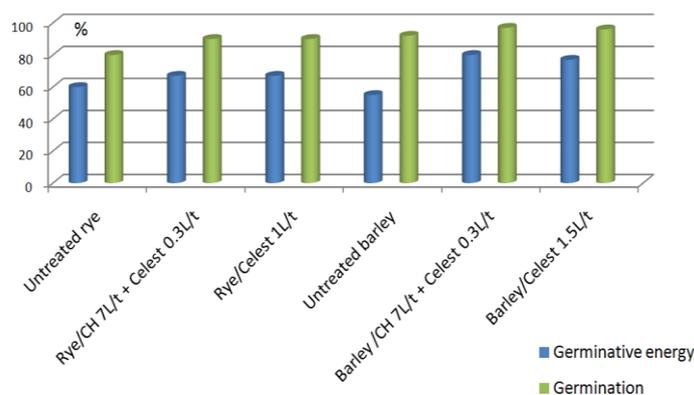


Fig. 8- Germination and germination energy of rye and barley seeds

Field test of fish collagen extracts on rape plants

Tests for the influence of fish collagen and gelatin pH on germination of rape seeds showed that the pH of 6 is the most favorable (Figure 9). Field experiments on seeds lost and rape seeds production revealed that the collagen hydrolysate (2L/ha) has no influence on rape seeds indehiscent properties alone, but in combination with crosslinked fish collagen hydrolysate (1L/ha) increases the seed lost number by 25% and the production of rape seeds by 6% (Fig. 10).

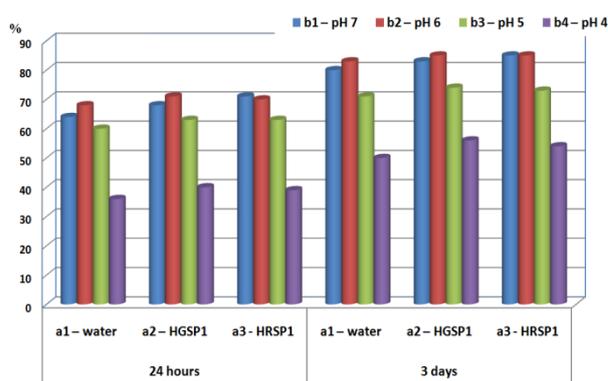


Fig.9-The rape seeds germination increase after treatment with fish gelatin (a2) and fish collagen hydrolysate (a3)

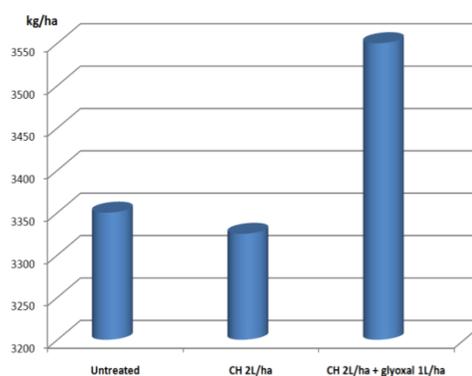


Fig.10-The rape seed production after treatment with crosslinked fish collagen hydrolysate.

Collagen extracts showed versatile properties for different applications in seeds and plant treatment with a high potential for reduction of synthesis chemicals and with improved ecological impact. The new applications were optimized in view of designing new added value biostimulants and fertilizer products for a circular economy.

CONCLUSIONS

New additives based on collagen hydrolysate and gelatin from by-products of different origin were extracted, processed and characterized in view of seeds and plants growth biostimulation and nutrition. The pilot level extraction showed the possibility to obtain bioactive products with free amino acid content and chemical characteristics compatible with seed and plant treatment. The laboratory and field experiments on barley, rye and rape seeds proved the possibility to reduce pesticides concentration and to stimulate germination due to the available free amino acids and organic nitrogen. Film-forming properties of fish collagen were improved by crosslinking with glyoxal in order to develop indehiscent properties for

rape siliques treatment. The collagen additive represents an ecological product with smart properties for agriculture use, tested at pilot level for cereal seeds and rape crop treatment.

ACKNOWLEDGEMENTS

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DYNAMICS OF THE POSTFILOXERIC ROMANIAN VITICULTURE

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Abstract:

*In the mid-nineteenth century, as a result of increased trade between European and American continents and especially due to the import of American vines, a tiny insect appeared within the European vineyards, insect that will be responsible for a real environmental disaster. It's about *Dactylosphaera vitifoliae* (syn. *Phylloxera vastatrix*), belonging to the Homoptera Order. The great impact that it had the appearance of *Phylloxera* in Europe marked the history of Romanian and world viticulture. Thus, from then until nowadays, within the specialty literature, we can discuss about three phases (eras), distinct namely: prefilloxeric stage, filloxeric stage and postfilloxeric stage.*

Key words: *Dactylosphaera, Phylloxera*, direct producing hybrids (H.P.D.)

INTRODUCTION

Dactylosphaera vitifoliae (syn. *Phylloxera vastatrix*) pest invasion in Europe, was an event that took place in the nineteenth century and thousands of articles and hundreds of studies were written in this context. Unfortunately, its negative effects are found even today, after about 140 years.

Here is described the powerful invasion:

By the middle of the last century the French vineyards were attacked by a microscopic fungus disease called powdery mildew or *Oidium*. The yields of the vineyards decreased and reached a low quality wines. An important branch of economy of the country was in danger.

As in North America were cultivated very resistant vines to mildew, they imported these type of vines. Nobody suspected that importing the vines they brought to the Old World the greatest enemy of European vines. In 1863 the growers of the famous Bordeaux vineyards had to get acquainted with it.

Soon the most flourishing vineyards are destroyed. Of whom ? Mister! Research is done, but nothing. Only after about five years, it was found on the roots of the dried vines, a small insect that entomologists called it *Rhizophis*. The same insect is found on the roots of vines grown in a greenhouse in the surroundings of London.

Soon, they found that the Rhizophis was in fact *Phylloxera vastatrix*, an insect discovered on vines since 1854 in North America by the French entomologist Planchon. The mystery was now clear. So, through the American vines introduced from the New World, *Phylloxera* insect destroyed mainly European vine roots. The pest is spreading swiftly across the continent. The vineyards were falling one after another due to this tiny insect, such as the cities in a big storm. Nothing can stand in front of the attacker "[2].

Phylloxera disaster found the Romanian viticulture unprepared with a total cultivated area within the Romanian Kingdom of 137,176.00 ha. Although officially the emergence of *phylloxera* is recorded in 1884 when the vineyards disappeared en masse, it seems that the pest was introduced accidentally into the country in 1877 through an import of infected vines from France by Professor Ananescu from Chițoran (vineyard Dealu Mare).

In Transylvania, the *Phylloxera* came in 1880 first in the vineyard of Arad and in 1883 in Șiria vineyards. Its further spread in the whole country has been done relatively quickly.

To limit the effects of the disaster was formed in 1884 the “Phylloxera Commission”, which was tasked to follow up the attack and to establish measures to combat the pest. The results were not-succesfull and thus to restore the vineyards were used the direct producer hybrids (H.P.D.) and import grafted-vines from France, Algeria, Morocco and Austria. There were also imported American vines used as rootstocks *V. riparia*, *V. Berlandieri*, *V. rupestris*, *V. cordifolia*.

After years of attempts to control the insects by direct chemical and physical methods, it was concluded that the only effective way to combat the insect is an indirect one, the grafting of the European vines on American vines or their hybrids resistant to phylloxera attack. The success of this method was based on American spontaneous species that, over time, they are constantly confronted by the attack of phylloxera, by natural selection. [7].

MATERIAL AND METHODS

For an accurate analysis of the Romanian vines areas dynamics we have used data presented for the first time, data collected from the National Archives and of the National Institute of Statistics (I.N.S.).

Phylloxera disaster effect is found in the ratio of European vines areas cultivated on their own roots / direct producer hybrids / grafted European vines. These data are shown in the chart no. 01 and in the table.no 01 [1, 3, 4, 5, 6].

Graphic no.. 01 - Evolution of the Romanian vines areas cultivated with grafted hybrids (1859-2014)

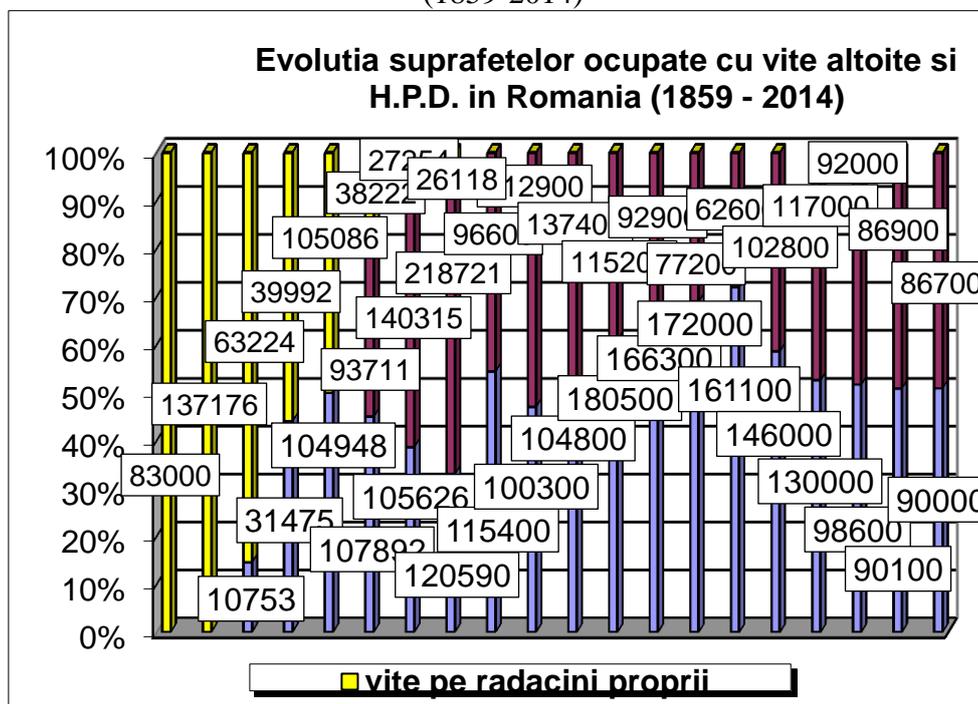


Table 1

Ratio of the European vines areas cultivated on their own roots / direct producer hybrids/grafted hybrids

No	Year	Total surface (ha)	European vines on their own roots		Direct producer hybrids (H.P.D.)		European grafted hybrids	
			ha	%	ha	%	ha	%
1	1859	83000	83000	100	-	-	-	-
2	1873	121520	121520	100	-	-	-	-
3	1880	137176	137176	100	-	-	-	-
4	1909	86018	63224	73,50	-	-	10753	12,50
5	1914	88124	39992	45,38	-	-	31475	35,72
6	1924	243996	105086	43,07	-	-	104948	43,01
7	1927	271690	38222	14,07	93711	34,49	107892	39,71
8	1933	328417	27254	8,30	140315	42,72	105626	32,16
9	1937	369042	26118	7,08	218721	59,27	120590	32,68
10	1948	220000	-	-	96600	43,91	115400	52,45
11	1955	228800	-	-	112900	49,34	100300	43,84
12	1965	312700	-	-	137400	43,94	104800	33,51
13	1975	295700	-	-	115200	38,96	180500	61,04
14	1980	259200	-	-	92900	35,84	166300	64,16
15	1985	249200	-	-	77200	30,98	172000	69,02
16	1990	246710	-	-	62600	25,37	161100	65,30
17	1995	253695	-	-	102800	40,52	146000	57,55
18	1999	248786	-	-	117000	47,03	130000	52,25
19	2005	224100	-	-	92000	41,05	98600	44,00
20	2010	177000	-	-	86900	49,10	90100	50,90
21	2014	176700	-	-	86700	49,07	90000	50,93

RESULTS AND DISCUSSIONS

If the vines area cultivated during the period 1873-1898 yards is constant increased till 1899 to 198,428.00 ha after 1900 the cultivated vines area continuously decreased, reaching in 1902 at 142.720 ha and in 1907 at 82.960 ha, as a result of the plantations decimation and of insufficient number of replanting vines.

Only after 1908 it is registered a slight recovery in the wine sector, the vines areas slightly increased and reached in 1909 the value of 86.018 ha (of which 63.224 ha with Romanian vines, 10.753 ha with American vines and 12.041 ha with fruitless plantations) and in 1914 reached the value of 88.124 ha (of which 39.992 ha with Romanian vines, 31.475 ha with American vines and 16.657 ha with fruitless plantations).

It should be noted that at that time the “Romanian vines” meant indigenous grafted plantations which included direct producer hybrids (HPD); the “American vines” meant grafted plantations and the plantations for American rootstocks and the “fruitless plantations” meant young vine plantations and vine nurseries [1].

To ensure the necessary vines seedlings it is established in 1885 at Barațca-Păuliș (Transylvania) the first vines nursery for the production of grafted vine, phylloxera-resistant by green and ground-grafting. The next nurseries were established in the Romanian Kingdom in Strehaia - Mehedinti County (1889) and in Țintea - Prahova County (1889), followed by the period of 1889-1892 with further 12 vines nurseries in the main vineyards of the country.

Due to the high needs for the vines seedlings and as a consequence of massive imports were indiscriminately introduced into the Romanian vineyards many foreign varieties, plus a considerable amount of direct producer hybrids, much lower than the local varieties quality.

During the interwar period the development of the vines plantations and especially of those cultivated with direct producer hybrids (HPD) vines was as follows:

- **1924** – of about 243.996 ha, **43.07%** (105,086.0 ha) were cultivated with local non-grafted vines including direct producer hybrids (HPD).;
- **1927** - of about 271.690 ha, **34.49%** (93711.0 ha) were cultivated with direct producer hybrids (HPD) vines. It should be noted that only in 1927 within the official statistics it appeared distinctly individualized the areas cultivated with HPD;
- **1933** - of about 328.417 ha, **42.72%** (140.315 ha) were cultivated with H.P.D.

• **1937** - the area cultivated with vineyards in Romania reaches 369,042.00 ha of which 59.27% (218.721 ha) with., which shows that the percentage of H.P.D was maintained despite the anti H.P.D law adopted at that time.

According to the data collected from the National Archives of Romania [1], the distribution of the total area of about 273 195 hectares on different geographical regions was as follows:

- The “old Romanian Kingdom” had a total area of 142.495 ha (52.16%) with 70.800 ha H.P.D, 55.800 ha grafted vineyards and 16,000 ha non-grafted vineyards;

- Bassarabia had a total area of 90.200 ha (33.02%) with 63.100 ha H.P.D, of 18.000 ha grafted vineyards and 9.000 ha non-grafted vineyards;

- Transilvania, had a total area of 40.500 ha (14,82%) with . 6.400 ha H.P.D, vii altoite 31.800 ha grafted vineyards and 2.300 ha non-grafted vineyards;

It is noted that besides Transylvania region where the grafted vineyards net exceeded the H.P.D. vineyards and those with indigenous grafted vines, within the remaining Romanian counties were prevalent the HPD vineyards, with a total area of 140.315 ha (42.70%), followed by the grafted vineyards cultivated on an area of 105.626 ha (32 , 20%).

Although hidden from the public opinion by a regime that wanted to show only their achievements, the vineyards evolution and especially of those cultivated with H.P.D. during the communist period, was as follows:

• **1948** - from a total area of 212.000 ha cultivated vineyards, **45,57%** (96.600 ha) was cultivated with H.P.D.vineyards;

• **1950** - from a total area of 223.000 ha, **47,40%** (105.700 ha) was cultivated with H.P.D.vineyards;

• **1955** - from a total area of 213.200 ha, **52,95%** (112.900 ha) was cultivated with H.P.D.vineyards;

• **1965** - from a total area of 242.200 ha, **56,73%** (137.400 ha) from a total area of • **1975** - from a total area of 295.700 ha, **38,96%** (115.200 ha) was cultivated with H.P.D.vineyards;

• **1980** - from a total area of 259.200 ha, **35,84%** (92.900 ha) was cultivated with H.P.D.vineyards

• **1985** - from a total area of 249.200 ha, **30,98%** (77.200 ha) was cultivated with H.P.D.vineyards [3, 4].

CONCLUSIONS

The consequences of the *Dactylosphaera vitifoliae* (syn. *Phylloxera vastatrix*) in Romania are extremely difficult to be capitalizing. What we know with certainty it is that the real effects of this ecological disaster is felt even today, after about 140 years. Thus, many Romanian traditional varieties of *Vitis vinifera* were lost forever from the national and European vineyards patrimonium. Although are "dry", the figures highlight a back in time of the Romanian viticulture. We note an „explosion" of H.P.D. vineyards, large areas being cultivated with un-improved hybrids within the interbelic vineyards range with low productivity and poor quality.

In conclusion, we can say that the “involution” of this sector, was as follows:

- **1990** - from a total area of 223.600 ha cultivated vineyards, **28,00%** (62.600 ha) were cultivated with H.P.D vineyards;
- **1995** - from a total area of 248.800 ha, **41,32%** (102.800 ha) were cultivated with H.P.D vineyards;
- **1999** - from a total area of 247.000 ha, **47,37%** (117.000 ha) were cultivated with H.P.D vineyards;
- **2005** - from a total area of 190.600 ha, **48,27%** (92.000 ha) were cultivated with H.P.D vineyards;
- **2010** - from a total area of 177.000 ha, **49,09%** (86.900 ha) were cultivated with H.P.D vineyards;
- **2014** - from a total area of 176.700 ha, **49,07%** (86.700 ha) were cultivated with H.P.D vineyards [3, 5, 6].

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FERRIC CHLORIDE INFLUENCE ON THE ACTIVE MICRO-ORGANISMS IN WASTEWATER TREATMENT PLANTS

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Abstract

The biological treatment of wastewater is a biotechnological process through which the dissolved biological impurities and colloidal suspensions are transformed by micro-organisms into innocuous bio-degradation products (carbon dioxide, water, other products), and in new cellular mass (biomass).

All the biological processes are influenced by temperature. The microorganisms' activity and the oxygen solubility in water depend on the environmental temperature and pressure. The optimal temperature of the biological treatment is between 10°C and 30°C. Lower temperatures are not harmful per se, but the bacterial metabolism is significantly slowed, especially in case of nitrification and de-nitrification bacteria. Temperatures higher than 35°C are not preferred by bacterial cultures, and thus they should be avoided.

In order to operate efficiently, bacteria need nutrients, which are characterized by the proportions of carbon, nitrogen and phosphorus in the wastewater.

The present study is focused on monitoring the physiological behavior of the micro-organisms (bacteria) at low temperatures, in a biological reactor, for reducing the ammonium concentration through addition of ferric chloride.

The obtained results represent the values of a study performed during the year 2015 regarding the physiological state of the micro-organisms, when ferric chloride, in different amounts, has been added. The conclusions of this study enabled us to optimize the functioning parameters, for the treated water to comply with the current Romanian regulations.

Keywords: wastewater, reducing ammonium concentration, micro-organisms.

INTRODUCTION

For sludge decomposition, a major role is played by nitrification bacteria, suspended in the wastewater to be treated.

Microorganisms decompose organic substances by biochemical processes, such as oxidation and reduction, and they also decompose nutrients, by nitrification - denitrification processes.

Nitrification is the transformation of ammonia into nitrite and then to nitrate, with the help of two groups of aerobic bacteria, called nitrifying bacteria, where *Nitrobacter* species prevails. In denitrification, organics, oxydated combinations of nitrogen, nitrates and nitrites are transformed, by heterotrophic (facultative anaerobic) microorganisms into elementary nitrogen, also resulting carbon dioxide and water. Simultaneously a certain amount of carbon

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is consumed. For the stabilization of the activated sludge, a continuous sludge recirculation system is required.

Because the nitrification bacteria have a slow growth rate, the environmental conditions have a paramount importance. The efficiency of the nitrification process is about 80 – 90% if the water temperature is in the range 12 – 40°C, which is not the case during the cold season, when the temperature drops significantly, thus decreasing the bacterial growth rate.

All bacteria incorporate a certain amount of phosphorus within their cells during the growth process, used mainly for the DNA replication. With activated sludge, phosphorus removal is performed by heterotrophic microorganisms, named polyphosphate accumulating bacteria. The amount of these bacteria can be increased in the activated sludge, therefore the name given to this process: biologically enhanced phosphorus removal.

In our study we have focused on operational tests for the reduction of ammonia concentration using a classic coagulant, aqueous solution of ferric chloride (FeCl_3), 40%. We have decided to use this material because of the alkalyne character of the water (pH above 7.5 units). The importance of this additive for flocculation – coagulation is well documented (Park et al., 2006), and it is known its beneficial effect for the removal (by precipitation) of phosphates (Dima, 2005). Although presented in literature (Meiklejohn, 1953), the presentation of the beneficial effects of FeCl_3 on nitrification is not as well documented as its other effects.

The tests have been performed during the whole year of 2015.

The results allowed us to improve the operating parameters of the Medias City waste water treatment plant (WWTP), mainly the reduction of nitrogen in the effluent.

MATERIALS AND METHODS

The study has been carried out in a municipal wastewater treatment plant (WWTP), commissioned on October 31, 2013 and serving for a city with 74,000 Equivalent inhabitants (i.e. 150 L water and 60 g BOD per day per inhabitant), and with little industrial impurification of the waters to be treated. Considering these 150 L per person and day, a monthly input flow of 330,000 m³ household wastewater is supposed to be treated.

The operating parameters of the WWTP are presented in table 1, as the average monthly values. Air and water temperature have been measured within the plant, and the precipitation values have been given by the local weather station.

Water samples have been taken from admission (influent) and discharge (effluent – treated water), while activated sludge samples have been taken from the distribution chamber, after the aeration tanks and before the secondary clarifier. Each sample has had 1 L in volume and they were taken in sterile flask, then immediately transported and processed.

The presence of nitrification and denitrification bacteria within the sludge aggregates has been determined in order to understand their capability to remove $\text{NH}_4\text{-N}$, $\text{NO}_2\text{-N}$ and $\text{NO}_3\text{-N}$ from the secondary effluent, when adding various amounts of FeCl_3 . The ferric chloride dose depends on the suspended solid amount, the required treatment degree, flocculation conditions, wastewater flow, etc. For the purpose of the operation parameters characterization, pH, dissolved oxygen and water temperature have also been monitored.

In the years 2013 and 2014, when the WWTP was starting to operate, and the amount of added FeCl_3 was calculated on theoretical basis, considering only the stoichiometry of the process, the amount of phosphorus in water was above the maximal admitted concentration (2 mg/L of treated water). These poor results are due mainly to the multiple implication of FeCl_3 in the life of the complex ecosystems represented by bacteria in their environment. In order to avoid this situation, we have decided to calculate the amount of FeCl_3 40% solution considering mainly the efficiency of phosphorus removal, i.e. comparing the effluent amount of Total-P with the maximum admitted concentration. The results, together with the number of nitrification and denitrification bacteria are shown in table 2.

The samples have been taken every week, starting with January 2015, while various amounts of FeCl_3 have been added. The following variables have been determined:

- number of ammonifying bacteria in plain peptone water;
- number of denitrification bacteria on De Barjac medium (Pochon and De Barjac, 1958);
- amount of ammonia in the treated water (effluent), measured spectrometrically using a Spectroquant device.

For the cultivation of each type of nitrification and denitrification bacteria, five test tubes have been inoculated under sterile conditions, with the respective culture medium (1 mL) and then they were incubated at 28°C for 10 days. The resulted cultures have been investigated macroscopically and microscopically.

The presence of nitrification bacteria in the samples has been confirmed by the release of NH_3 in the culture medium, using Nessler reagent, by changing the color to intense yellow, with or without precipitation, when adding one or two drops of reagent.

The presence of denitrification bacteria in the samples has been confirmed by the apparition of nitrites, resulted by the nitrates reduction, while a pink or red color given by the Nessler reagent in the De Barjac medium reveals their occurrence (Pochon, 1954).

RESULTS AND DISCUSSIONS

In Table 1 there are presented the monthly average air and water temperature, precipitation and input flow, as mean of the daily values.

Table 1. **Air and water temperature, precipitation and input flow for the year 2015.**

Month	Air temp. °C	Water temp. °C	Precipitations, mm	Input flow, m ³
January	- 1.67	6.7	53.6	266823
February	- 0.52	7.0	55.0	212029
March	4.99	10.6	67.8	237771
April	8.75	14.1	95.6	212710
May	15.30	16.8	168.2	238911
June	17.99	19.2	367.2	273837
July	21.00	22.2	52.8	220525
August	20.71	22.5	79.2	248973
September	17.17	20.8	220.4	250985
October	9.06	18.0	79.8	195059
November	5.05	15.1	63.4	202140
December	1.31	11.3	7.8	185690
Mean value	9.93	15.35	109.2	228788
Total value	-	-	1310.8	2745453

It is worth to note the two months, June and September 2015, when excessive unusual rain was noted (on June 26, and the last decade of September, respectively), with the consequence of flow increase, dilution of nutrients and problems in normal WWTP operation. Even so, the amount of wastewater generated by the city is lesser than the envisaged one.

For the FeCl_3 dosage, besides temperatures, the chemical parameters of the influent are of great importance, and these are shown in Table 2.

Table 2. **Chemical parameters of the influent, during the year 2015, as well as the considered input values.**

Month	COD mg/L	BOD ₅ mg/L	NH_4^+ mg/L	N_{total} mg/L	NO_2^- mg/L	NO_3^- mg/L	P_{total} mg/L	TSS mg/L	pH unit
January	388.90	245.00	52.90	52.90	0.65	4.46	5.40	245.20	7.80
February	429.30	288.00	45.40	52.20	0.68	2.26	4.80	275.40	7.80

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March	472.70	346.00	43.10	42.10	0.51	1.15	6.70	273.20	7.60
April	471.90	292.00	54.50	36.30	0.11	1.17	4.70	205.20	7.70
May	368.70	257.00	46.90	53.80	0.16	0.73	6.50	236.40	7.60
June	355.00	190.00	53.00	61.90	0.06	0.99	6.30	210.50	7.50
July	340.70	173.00	42.00	49.30	0.32	0.93	5.20	171.20	7.60
August	336.20	179.00	45.60	55.00	0.04	0.77	4.70	129.70	7.70
September	390.60	236.00	51.20	57.70	0.05	0.76	6.10	151.40	7.60
October	432.30	238.00	55.70	59.00	0.04	0.87	5.50	181.10	7.70
November	491.20	306.00	57.20	63.30	0.02	0.76	6.40	199.30	7.70
December	522.60	334.00	62.70	68.10	0.13	1.01	7.20	225.50	7.70
MEAN	416.68	257.00	50.85	54.30	0.23	1.32	5.79	208.68	7.67
Designed	357	178	-	36	-	-	8.2	208	-

It can be seen that ammonia is the main component of the total nitrogen. Table 2 also presents the main WWTP design parameters, and it can be seen that the operation chemical conditions are harder than the designed ones in what COD, BOD and phosphorus concerns.

Based on these input parameters, various amounts of FeCl₃ solutions have been added, in several doses per day. The amounts of the FeCl₃ 40% solutions added every month are presented in table 3.

Table 3. Amount of FeCl₃ solution and the number of nitrification and denitrification bacteria (number of bacteria per gram of dried sludge)

Month	FeCl ₃ 40%, L/month	Nitrification bacteria	Denitrification bacteria
January	5700	1785	1695
February	5959	2354	2874
March	5512	2858	2418
April	4217	3128	2658
May	4175	3573	2897
June	3239	4479	2916
July	1911	5248	3114
August	2414	5985	2689
September	5179	4482	1742
October	4860	4342	1574
November	4248	4512	1640
December	5392	2415	2317
TOTAL	52806	45161	28534
Monthly average	4400	376.3	237.8

It is worth to note that, even in the wintertime, when the water temperature was significantly low, the bacteria have survived, due also to the beneficial effect of FeCl₃ and this has been reflected in the effluent chemical parameters.

After the addition of the above mentioned amounts of FeCl₃, and operating the WWTP as programmed, the results were in accordance with the expectations, the effluent parameters

being under the Maximal Admitted Concentrations (MAC) stated by the Romanian norms (NTPA 01-2002, with the subsequent modifications), as it can be seen in Table 4.

Table 4. Chemical parameters of the effluent, during the year 2015, as well as the Maximal Admitted Concentrations.

Month	COD mg/L	BOD ₅ mg/L	NH ₄ ⁺ mg/L	N _{total} mg/L	NO ₂ ⁻ mg/L	NO ₃ ⁻ mg/L	P _{total} mg/L	TSS mg/L	pH unit
January	30.90	5.00	4.45	14.90	0.46	49.50	1.50	6.70	7.60
February	24.70	6.00	3.30	16.00	1.38	39.10	1.00	3.20	7.70
March	31.30	9.00	1.17	12.60	1.15	39.60	1.30	5.30	7.60
April	28.50	8.00	0.88	14.50	0.66	39.00	1.20	2.80	7.70
May	20.10	7.00	0.09	13.94	0.06	36.10	1.40	2.60	7.50
June	24.50	7.00	0.08	10.64	0.04	35.90	1.30	2.90	7.60
July	26.10	8.00	0.36	12.50	0.11	35.40	1.00	4.50	7.80
August	21.50	7.00	0.07	10.08	0.05	32.20	1.30	3.60	7.70
September	22.80	7.00	0.15	10.98	0.07	30.10	1.30	2.60	7.60
October	20.10	6.00	0.08	11.10	0.04	32.50	0.90	2.30	7.70
November	20.50	10.00	0.07	11.66	0.04	32.80	1.40	2.00	7.60
December	20.80	7.00	0.13	13.01	0.03	32.20	1.50	1.85	7.70
Mean	24.32	7.25	0.90	12.66	0.34	36.20	1.26	3.36	7.65
MAC	125	25	3	15	2	37	2	35	6.5-8.5

From the table it may be seen that the amount of phosphorous in the effluent is low, this proving that organic phosphor have been transformed by bacteria into orto-phosphates, and then precipitated by FeCl₃.

The main achievement during the whole year of 2015 was that the maximal admitted concentrations have been observed during all the months (exception February, when the input flow was smaller than expected, and BOD higher, this corroborated with low temperatures).

This was possible by a careful monitoring of input and output parameters, corroborated with the controlled variation of operational parameters (air flow, FeCl₃ addition)

The good functioning of the WWTP was also proven by the efficiency of N and P removal, calculated as (Ianculescu, 2001):

$$Ef = \frac{V_f - V_i}{V_i} \times 100$$

Where:

Ef = removal efficiency, %

V_i = initial value of the considered parameter

V_f = final value of the considered parameter.

Based on the data presented in Tables 3 and 4, the N and P removal efficiency are presented in table 5.

Table 5. Removal efficiency of Total Nitrogen and Total Phosphorous

Month	N_{total}	P_{total}
January	71.83	72.22
February	69.35	79.17
March	70.07	80.60
April	60.06	74.47
May	74.09	78.46
June	82.81	79.37
July	74.65	80.77
August	81.67	72.34
September	80.97	78.69
October	81.19	83.64
November	81.58	78.13
December	80.90	79.17
Mean value	75.7	78.1

It may be seen that in both cases the removal efficiency is high, and this is due to the proper WWTP operation, including FeCl₃ addition.

CONCLUSIONS

From the above presented data, it may be seen that the addition of FeCl₃ 40% is beneficial, even under the hard circumstances, with loading values exceeding those considered for the design, the WWTP was supposed to operate during the year of 2015:

- the nitrate and ammonium concentrations in the effluent are constantly under the MAC as stated by NTPA 001 of 2005;
- total phosphorous is also under the MAC
- pH is within the prescribed values;
- the removal efficiency is very good.

The addition of FeCl₃ is a good solution for improving the functioning of our wastewater treatment plant, with low consumption and good results.

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CONSERVATION AND IMPROVEMENT OF GRASSLAND BIODIVERSITY BY ADOPTING SUSTAINABLE MANAGEMENT FOR GRASSLAND AGROECOSYSTEM RESOURCES

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Abstract

The activity of an agricultural enterprise is run within an ecosystem, it being characterized by intertwining and integration of the two components. The achievement of this relationship depends on the resulting performance, which requires organization policies and strategies to be adopted for the biotechnical and economic processes. For the purpose, we need to identify which principles, techniques and methods are existing within the ecosystem, as well as their usefulness in organizing agricultural enterprises in order to ensure rationality and optimal proportions amongst its various components. The agricultural ecosystem is essentially rendered artificial; therefore, it should be monitored and run according to well-defined rules, in order to preserve and improve not only biodiversity but also quality and profitability of production. The paper leads to the general conclusion that the promotion of eco-technical practices within the grassland agroecosystem results in a multifunctional meadow, primarily focused on obtaining a pastoral value with a corresponding loading expressed in livestock units per hectare of pasture, i.e. biodiversity conservation and improvement of known, as Romanian grasslands are known for their varied floristic composition of high biodiversity indices.

Key words: biodiversity, biotechnological, conservation, sustainable, economic, ecosystem, management

INTRODUCTION

The paper assumes that a sustainable agriculture development should aim at increasing production capacity whilst maintaining natural resources. It is inferred that a management system should be oriented towards meeting changing needs of people, whilst maintaining or enhancing environmental quality and the conservation of natural resources. Agricultural ecosystems consist of specific subsystems, as our attention is being focused on the pasture agroecosystem, of which main objective is designing and implementation of long-term economically viable measures capable of providing a high pastoral value, namely biodiversity conservation and improvement [3], [5]. For this purpose, it is necessary to include other activities in addition to those specific to agricultural management; the newly included activities should be dedicated to stimulating biodiversity, ensuring harmonious development and integration of the grassland ecosystem in an environmentally friendly medium. It follows that a sustainable development management of the grassland agroecosystem is a complex process that relies on organizing, administration and management, as opposed to natural ecosystems that are self-organizing and cannot be maintained without human action. Man

must intervene with external energy, *i.e.* crop energy, under two forms: biological (human and animal labor) and technological (machines, equipment, etc.) [6]. Our research aimed to achieve a high pasture value, *i.e.* biodiversity conservation and improvement by promoting the sustainable resource management of the specific measures characterizing the grassland agroecosystem, with a special focus on fertilization.

MATERIAL AND METHOD

The experiment was located on the North-Eastern top of the Cindrel Mountains, at an altitude of approximately 1,430 m, near the Păltiniș mountain resort, on the summit called Vălari, covered by red fescue (*Festuca rubra*). Land exposure was Southern with a slight slope, approximately 5 % [2]. The area was surrounded with vast spruce forests and large areas of natural grasslands. Weather conditions were characterized by annual average air temperatures below 5⁰C on the slopes and the peaks of the middle mountains (4.5⁰C Păltiniș – top, 4⁰C - Păltiniș resort), falls below 0⁰C on the high mountain peaks (Buiuc and collab., 1975). The warmest month was July when values were 12.7⁰C Păltiniș - top and approx. 7-8⁰C in the high mountain area. The average of the coldest month, January, decreased to -4.3⁰C Păltiniș - top, -4.1⁰C, and below -9÷-10⁰C in the high mountain area [1]. *Highest temperature* reached 30.0⁰C in Păltiniș - resort and only 20 - 23⁰C on the highest mountain peaks. *Average annual rainfall* reached 910 mm in the middle mountains (Păltiniș) and increased to 1,350 mm on the alpine tops. *The highest average amounts* reached 147.4 mm in June – Păltiniș. In the alpine top areas, they recorded over 150-160 mm in June. The lowest monthly average amounts were recorded in the middle mountains, 41.5 mm in November – Păltiniș. On the Păltiniș experimental field, the soil was acid-brown belonging to the cryptosporidium subtype (hidden spode characters) on acid rock, of which morphologic, physical and chemical properties were as follows: small-medium grainy structure, slightly glomerular in the first 30 cm, polyhedral, sub-angular in the Bv horizon; loamy-sandy-dusty to loamy at 30 cm size fits the profile; low levels of absolute and apparent density, influenced by the high content in organic matter; good total porosity; the high content in organic matter, slightly or increasingly moist indicates a strongly moist soil (raw humus) with a high share of folic acids; pH varied between 4.62-5.10 in the aqueous extract and 3.78 -4.27 in the saline extract, indicating a strongly acidic reaction; the degree of base saturation values, of less than 30%, indicated an oligo-basic soil. Knowing that grasslands in the area used to be utilized for both grazing and haymaking, we

performed two similar experiences on the same location, one for each mode of use. The experiment was conducted during a three year - time period, according to the method of subdivided lots with four separate blocks (replications) - each block consisting of three plots: unfertilized control, fertilized with manure (20 t/ha) and fertilized with minerals (N₁₀₀P₅₀K₁₀₀). The blocks were further divided into two variants (for haymaking and grazing, respectively), each having an area of 10m² (5x2m). In the haymaking variant, production consisted in the scythed grass and after grass, while in the grazing one, based on *Festuca rubra*, three harvests were performed when plants reached their grazing height. Dry matter was determined by oven method. Yields were obtained by weighing the harvest immediately after mowing. Sampling was carried out following the dew disappearance, *i.e.* at noon and in the afternoon. The floristic composition was determined by the double meter method that analyzes grass by linear vegetation surveys for each group. We chose the volume method consisting in identification of points located 5 cm away from each other into a circle of 2 cm diameter. Thus, we assigned a grade from 1 to 6, the sum of grades within a dot being 6, for each species grown within the area described above, which was measured at every 5 cm.

RESULTS AND DISCUSSIONS

The floristic composition resulting from the diagnosis showed that poaceae was predominant (67%) in yield formation and the grassland layer, where the main species was *Festuca rubra*. Other fodder-important *Poaceae* present in this type of grassland were *Antoxatum odoratum*, *Agrostis rupestris*, *Agrostis capillaris*, *Cynosurus cristatus*, *Phleum alpinum*, *Poa pratensis*. The share of fodder plants belonging to the Fabaceae family was low (17%) and exemplified by such species as: *Trifolium repens*, *Trifolium pratense*, *Trifolium alpestre*, *Lotus corniculatus*, plus *Genista tinctoria*. Plants from other families had a low share in the floristic composition and were represented by: *Achillea millefolium*, *Alchemilla vulgaris*, *Taraxacum officinale*, *Leontodon autumnalis*, *Plantago lanceolata*, *Plantago media*. We also encountered plants with no or low fodder value, such as *Veronoca chamaedris* and *Rumex acetosela*, and even harmful plants such as *Nardus stricta* that equals or exceeds the share of *F. rubra*, the *Festuca rupicola* and *Genista tinctoria* species. Bushes and shrubs were also present: *Vaccinium myrtillus*, *Vaccinium vitis-idaea*, *Juniperus sibirica*, *Pinus mugo*, etc. This showed that, although they represented an important fodder resource, grasslands were decaying as a result of poor

management over the past recent years, requiring adoption of a sustainable management strategy leading to higher pasture value, as well as biodiversity conservation and improvement. The pasture of the analyzed grasslands was estimated as being of a medium value, which required the application of value-adding works aimed at biodiversity conservation and improvement. The works consisted in destroying the molehills and removal of the woody vegetation, autumn and spring fertilization, given that “on the mountain meadows fertilization increases the Gramineae share both by grazing and mowing, while legumes increase by mowing”. The evolution of the floristic composition stressed that the application of measures to improve permanent natural grasslands contributed to biodiversity conservation and improvement, acting both for the conservation and improvement of natural resources, and the improvement of grassland quality and profitability. Thus, table 1 shows an increase in number of the species on the grassland from 23 species in the controls to 28 species on the manure-fertilized grassland and 26 species into the mineral-fertilized soil. Grassland biodiversity is influenced by several management factors, among which fertilization, over sowing, rational use [2]. The evolution of the floristic composition stressed that the application of measures to improve permanent natural grasslands contributed to biodiversity conservation and improvement, acting both for the conservation and improvement of natural resources, and the improvement of grassland quality and profitability. Thus, table 1 shows an increase in number of the species on the grassland from 23 species in the controls to 28 species on the manure-fertilized grassland and 26 species into the mineral-fertilized soil. In our experiment, the most important impact on grassland biodiversity resulted from organic fertilization (table 1), manifested both in its structure, by an increase in number of species, and in the floristic composition, by the increase in share of valuable plants [2], [7]. Our research highlighted the role of permanent grassland fertilization with manure in order to improve both the productive potential and the floristic composition, which leads to biodiversity conservation and improvement. The results were consistent with the results of similar research, highlighting the positive effects of the organic fertilizers applied to grassland [5]. If applied regularly and rationally, organic fertilizers can replace chemical fertilizers completely [2].

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Table 1. Calculation of the pasture value over the entire experimental period

Species	V1 – unfertilized			V1 – manure 20 t/ha			V3 – N ₅₀₊₅₀ P ₅₀ K ₁₀₀		
	%PC	IC	PC x IC	%PC	IC	PC x IC	%PC	IC	PC x IC
Gramineae	67.0			62.0			70		
<i>Festuca rubra</i>	30.0	3	90.0	27.0	3	81.0	32.0	3	96.0
<i>Anthoxacum odoratum</i>	7.0	1	7.0	3.0	1	3.0	4.0	1	4.0
<i>Agrostis rupestris</i>	5.0	1	5.0	6.0	1	6.0	4.0	1	4.0
<i>Agrostis capillaries</i>	4.0	3	12.0	8.0	3	24.0	9.0	3	27.0
<i>Briza media</i>	4.0	1	4.0	1.0	1	1.0	2.0	1	2.0
<i>Cynosurus crestatum</i>	3.0	3	9.0	2.0	3	6.0	3.0	3	9.0
<i>Phleum alpinum</i>	3.0	2	6.0	3.0	2	6.0	4.0	2	8.0
<i>Poa pratensis</i>	2.0	3	6.0	6.0	3	18.0	5.0	3	15.0
<i>Nardus stricta</i>	6.0	x	X	1.0	x	x	2.0	x	X
<i>Festuca rupicola</i>	3.0	1	3.0	2.0	1	2.0	2.0	1	2.0
<i>Trisetum flavescens</i>	-	-	-	3.0	4	12.0	-	-	-
<i>Poa annua</i>	-	-	-	-	-	-	3.0	2	6.0
Leguminous plants	17.0			21			12		
<i>Trifolium repens</i>	3.0	4	12.0	6.0	4	24.0	5.0	4	20.0
<i>Trifolium pratense</i>	3.0	4	12.0	4.0	4	16.0	2.0	4	8.0
<i>Trifolium alpestre</i>	5.0	2	10.0	4.0	2	8.0	1.0	2	2.0
<i>Lotus corniculatus</i>	4.0	4	16.0	6.0	4	24.0	3.0	4	12.0
<i>Genista tinctoria.</i>	2.0	x	-	0.5	x	x	1.0	x	X
<i>Oxalis acetosela</i>	-	-	-	0.5	x	x	-	-	-
Other families	16.0			17			18		
<i>Achillea millefolium</i>	5.0	2	10.0	4.0	2	8.0	6.0	2	12.0
<i>Alchemila vulgaris</i>	2.0	2	4.0	2.0	2	4.0	3.0	2	6.0
<i>Taraxacum officinale</i>	2.0	2	2.0	3.0	2	6.0	3.0	2	6.0
<i>Leontodon autumnalis</i>	1.0	1	1.0	1.0	1	1.0	1.0	1	1.0
<i>Plantago lanceolata</i>	2.0	2	4.0	2.0	2	4.0	2.0	2	4.0
<i>Plantago media</i>	2.0	2	4.0	1.0	2	2.0	1.0	2	2.0
<i>Veronica chamaedris</i>	1.0	x	-	1.5	x	x	0.5	x	x
<i>Runex acetosela</i>	1.0	x	-	1.0	x	x	0.5	x	x
<i>Potentilla erecta</i>	-	-	-	1.5	1	1.5	0.5	1	0.5
<i>Campanula abietina</i>	-	-	-	0.5	x	x	0.5	x	x
<i>Luzula luzuloides</i>	-	-	-	0.5	x	x	-	-	-
TOTAL	23		216	28		259.5	26		247.5
Pasture value	43			51.9			49.5		
Pasture value assessment / UVM*ha ⁻¹	Average		1.12	Good		3.02	Average-good		2.9

CONCLUSIONS

Sustainable development of the grassland agroecosystem is complex and long, requiring an organized application of complex measures and works ensuring soil protection and a sustainable protection of the degraded lands.

Our research highlighted the role of permanent grassland fertilization with manure in order to improve both the productive potential and the floristic composition, which leads to biodiversity conservation and improvement.

The analyzed grassland had a poor floristic composition represented by 23 species of low fodder value, of which 10 belonged to the *Poaceae* family, 5 to the *Fabaceae* family and 8 to other botanical families.

The evolution of the floristic composition stressed that the application of measures to improve permanent natural grasslands contributed to biodiversity conservation and improvement, acting both for the conservation and improvement of natural resources, and the improvement of grassland quality and profitability.

Thus, table 1 shows an increase in number of the species on the grassland from 23 species in the controls to 28 species on the manure-fertilized grassland and 26 species into the mineral-fertilized soil.

The results were consistent with the results of similar research, highlighting the positive effects of the organic fertilizers applied to grassland. If applied regularly and rationally, organic fertilizers can replace chemical fertilizers completely.

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AIR QUALITY UNDER THE CONDITIONS OF ECONOMIC DEVELOPMENT OF THE CITY OF SIBIU

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Abstract

The beginning of the third millennium presents the current economy as a destroyer of its support systems, as the consumer of fixed assets of the natural capital, as based on fossil fuel, on driven cars that release CO₂ into the atmosphere thus altering the global climate and the beginning of the third millennium also portends a bleak future if there is no change to support a path bearable for the environment because "any environmental degradation tendency may undermine the civilization as we know it." Hence emerges the idea of dependence of the quality of the environment and its resources on the level of economic development, a theme that is the subject of this paper. The study seeks to establish the state at some point of the relationship between quality of the environment and the level of economic development and addresses the issue of air quality in relation to economic development in Sibiu where we identify the sources and causes for which air protection is a vital issue of the contemporary world in general and especially of the Sibiu community in particular.

Key words: air, conservation, development, economic, sustainable

INTRODUCTION

Sustainable development combines into a new superior synthesis organic economic growth, preservation and enhancement of natural and human health, social justice and ensuring democratic environment in community life [1]. The concept of "sustainable development" is first used by the Prime Minister of Norway, Gro Harlem Brundtland, in 1987, when as chairman of the World Commission on Environment and Development he presented the report "Our Common Future" in which he defined sustainable development as the "development that meets present needs without compromising the possibility for future generations to meet their own needs" [10]. Under this concept using the resources offered by the environment and the development of society in general, it must be organized in such a way as not to jeopardize the development opportunities of future generations [2]. This moment conveys to nature conservation and protection new insights with deep and comprehensive meanings, whose implications at economical level are oriented towards protecting nature against the negative aspects of society development, and towards conservation of the natural environment to benefit the people for rest and recreation [9]. For this "ecology needs to overlap the economy, namely to integrate environmental requirements in the assessment of economic activities" [3] and consequently to obtain "better reflection of

environmental damage caused by the economy and of the respective costs that must be covered by the society”[5]. This approach represents a challenge, because "there is no precedent in the action of transforming an economy based largely on market forces in an economy formulated on the principles of ecology" [3] and stems from the fact that the beginning of the third millennium presents the current economy as a destroyer of its support systems as a fixed assets consumer of the natural capital, as an economy based on fossil fuel, on driven cars that release CO₂ into the atmosphere thus altering the global climate [3] and also the beginning of the third millennium portends a bleak future if there is no change to support a path bearable for the environment because "any environmental degradation tendency may undermine the civilization as we know it"[11]. The study is based on the strategic diagnosis of the sustainable development of Sibiu where the primary objective for short and medium term is the quantitative and qualitative growth of the economy so as to ensure food security of the population, increasing its contribution to the external economic exchanges observing the requirements of protecting and improving the environment.

MATERIALS AND METHODS

Studies have targeted Sibiu - an area that has a uniform, remarkable habitat and ge-productive potential that paved the occurrence of a particular lifestyle, of a culture of their own and an original approach to eco-economic reality and relationships between the environment and the humans that live in it. The major objective of this research is the strategic diagnosis of Sibiu’s sustainable development, addressing the contradiction between the requirements of economic growth and limited resources on the one hand and the environmental damage on the other.

The research aimed at identifying both the problems and the potential of economic development in the context of maintaining a state of balance between the requirements of economic growth and environmental resources, namely to minimize environmental damage in order to better target the strategic measures for integrated, sustainable development.

RESEARCH METHODOLOGY

The many issues discussed when the discussion concerns the necessity for economic growth consistent with maintaining natural resources and minimize the environmental damage in the studied area ask for a research methodology able to adapt to territorial specificities. The organization behavior also influences both shareholders and also the

social and ecological environment, businesses having a social responsibility [14]. According to experts integrated sustainable development of cities with potential is a complex issue that for the formulated objectives calls for using several methods both quantitative and qualitative such as: study of statistical data and specialty literature in the field (reports, strategies, studies, monographs), semi-structured interviews with key local stakeholders, structured interviews to collect data on successful initiatives on environmental factors and PESTEL (political, economic, social, technological, environmental and legal) and SWOT (strengths, weaknesses, opportunities, threats) analysis, respectively the analysis of the relevance of opportunities and threats for identified strengths and weaknesses. Air quality monitoring is conducted in Sibiu city by two stations: one of urban type that evaluates the influence of "human settlements" on the quality of the air with a radius of representativeness of 1-5 km, and one industrial type station that evaluates the influence of industrial activities on air quality with a radius of representativeness of 100 m-1km. Both stations monitor pollutants such as: sulfur dioxide (SO₂), nitrogen oxides (NO_x), carbon monoxide (CO), ozone (O₃), volatile organic compounds (VOCs) and particulate matter (PM₁₀ and PM_{2,5}) and meteorological parameters (wind speed and direction, pressure, temperature, solar radiation, relative humidity, precipitation).

RESULTS AND DISCUSSION

One component of the concept of integrated sustainable development is controlling the impact of socio-economic activities upon the environment. From the point of view of the Romanian legislation there is the necessity for full adoption as quickly as possible of the concepts promoted in the ISO 14000 series as part of the overall alignment of Romania to the European Community law [8]. To identify the problems and the potential for economic development in the context of maintaining a state of equilibrium between the demands of economic growth and environmental resources while minimizing the environmental damage we must start from a more complete characterization of the investigated area for a dynamic connection of the economy to it. Therefore in this study we performed a diagnosis of the economic development in Sibiu municipality, a diagnosis which included its components and subcomponents and the factors influencing their upper turning within the development of a sustainable economy. Specifically we proceeded to the grouping of the dimensions of the framework of the living into a set of six criteria for macro-environment analysis for which we

used the PESTEL model (political, economical, social, technological, environmental and legal). Subsequently for each of the six criteria for analysis of the rural space according to the PESTEL model we identified sub criteria of which we selected those with high degree of relevance and correspondence for the study. For a most complete from an economical point of view analysis of Sibiu municipality we chose using SWOT analysis as well because it is the method of audit findings which combines endogenous potential conclusions with non-endogenous potential conclusions but it also allows the illustration of the problems and contributes to stating the answers for solving them. An overview of economic activities in Sibiu highlights the good progress (with some exceptions) in their development and their diversification in terms of ensuring the balance between economic growth requirements and environment resources by minimizing the environmental damage (Table 1). The centralized evolution of business activity in Sibiu is shown in the table from the analysis of which emerge the following: in 2010 a total of 8,910 businesses were in operation of which 99.93% belong to the SME category, which means a density in Sibiu city of 57.74 SMEs / 1,000 inhabitants, double the national average. Eloquent for the business development in Sibiu municipality is the record of a high rate of the income tax on the average income per capita at 31.12.2010 of 1546.97 lei [7]. We find that the economic activity in Sibiu recorded in 2010 a slight decline but it is above the level of development recorded in 2007 - the year of accession to the EU, is the starting year of the economic integration in the EU. All these call for the design and implementation of strategies that lead to a sustainable and diversified integrated economy in order to increase household incomes and economic viability of organizations with encouraging consumption of local goods and services. A better relevance of the two analyses is shown by the presentation of the common elements for the two analyses (Table 2).

Integrated sustainable development involves the use of resources without diminishing their value and obtaining a continuous benefit, ie the rational exploitation of resources and control of the impact of socio-economic activities on the environment. Air quality is determined by air emissions from stationary and mobile sources as well as from long-range transport of air pollutants. For an integrated sustainable development an adequate air quality requires maintaining pollutant emissions with acidifying, eutrophication effect and ozone precursors below the values of 918 thousand tons / year for sulfur dioxide (SO₂), 437 thousand tons / year for oxides nitrogen (NO_x), 523,000 tones / year for non-methane volatile organic compounds (NMVOC) and 210 thousand tons / year for ammonia (NH₃), values that are national emission ceilings (EC Directive, 2001). Air quality assessment and management

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is done by the National Assessment and Integrated Management System for air quality: SNEGICA. SNIEP, a part of SNEGICA, provides the institutional and legal framework for the inventory of emissions of pollutants into the atmosphere. The presented economic results show a concern at the level of Sibiu municipality for the integrated sustainable development also reflected in the impact of economic activities on air quality. This is well evidenced by a summary of research results on air quality in 2007-2011 (Table 3).

Table 1 Intensity of social and economic activities conducted in Sibiu municipality

No.	Companies according to NACE activities	Year	Turnover	Year	Turnover
		2007		2010	
	Companies - TOTAL	9.043	5.114.827.446	8.910	5.261.924.459
	Of which:				
1	Agriculture	93	42.692.331	80	32.058.337
2	Forestry	33	10.603.466	39	14.885.410
3	Industry	1.198	1.076.386.144	997	1.416.942.541
4	Construction	980	859.980.273	976	540.555.265
5	Trade	2.772	1.985.370.178	2.505	1.765.352.570
6	Tourism, hotels and restaurants	481	114.319.846	561	153.161.872
7	Transport	627	381.353.510	510	524.842.532
8	Information and communications	363	80.649.871	384	19.670.894
9	The services of the insurance , the banking and financial sector	116	24.454.839	119	12.735.425
10	Real estate	426	135.357.375	477	151.826.056
11	Legal and accounting services, centralized administrative services, management and management consulting services, as well as architectural and engineering services	935	162.046.160	970	192.198.954
12	Education	50	4.798.502	70	5.338.209
13	Health care and social assistance	226	36.298.690	226	37.274.654
14	Other activities	743	200.516.261	996	295.081.740

The results lead to the development of the following strategic options following the guidelines manifested at world level and towards overlapping ecologic with economy: improving educational infrastructure, promotion of measures to support businesses, promotion of programs to eliminate environmental hazards risks and to continuously reduce

the levels environment pollution, development and promotion of information and consultancy services in order to increase access to funding and business information, incentive to partnerships between enterprises - universities - key local stakeholders, encouraging of entrepreneurship, offering educational, financial, material and technical support and increasing attractiveness through efficient use of endogenous resources. The presented data highlight the positive developments in the city of Sibiu for the values of the monitored pollutants recorded by the continuous monitoring system of air quality.

Table 2. Common elements of PESTEL and SWOT analysis matrices

<i>SWOT</i>				
<i>Diagnosis PESTEL</i> <i>Diagnosis</i>	<i>ASSETS</i>	<i>WEAKNESSES</i>	<i>OPPORTUNITIES</i>	<i>THREATS</i>
Diagnosis of political environment			Promoting coherent policies compatible with the EU mechanisms, Creating a business friendly environment.	High degree of Taxation Large number of fees and taxes
Diagnosis of economic environment	The high share of SME, Exceptional tourism potential; The existence of industrial parks, High employment rate of working force; High degree of industrial specialization, Transport infrastructure in good condition.	Shortage of skilled and unskilled labor.	Possibility of accessing national and European funding for integrated economic development; Promotion of tax policies that facilitate saving and investment; University Center in expansion, Geographical location favorable for development.	The economic crisis, Reduced purchasing power, Low E.U. fundraising partnerships, Foreign competition.
Diagnosis of social environment	Administrative structures specialized in social services, Ethnic, religious and linguistic diversity; Developed university center; Numerous private companies that offer multiple and diverse training opportunities.	Low number of social services for the target group, Few partnerships: Enterprise - Universities - local key factors	Possibility of accessing funds for: Improving the quality and diversification of social and health services; Improving cultural and educational infrastructure	Ageing of the population, Persons under poverty and social exclusion
Diagnosis of technological environment	Capacity to support economic development, Physical infrastructure and adequate, related ICT	Underdeveloped cultural infrastructure	Possibility of financing projects in physical infrastructure and ICT, transfer of technologies	Low research and development expenses
Diagnosis of environment	The existence of parks, bodies of water and areas	The lack of a generalized	The possibility of accessing funds for	Aggressive urban

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	for leisure and recreation	system of selective waste collection.	rehabilitation of green areas; The promotion of policies for environment protection, pollution control and waste management, Programs to eliminate environment hazards risks and for continuous reduction of environment pollution.	development in natural environment, Shortcomings in environmental education of the community
Diagnosis of legally		The lack of legislative measures concerning funding and information in business domains	The possibility of funding youth entrepreneurship initiatives	

Table 3 Evolution of the amount of pollutants emitted into the atmosphere in Sibiu County in the period 2003-2011

<i>Code/ Type of station/ Location</i>	<i>Pollutant</i>	<i>Annual limit values* (µg/mc)</i>	<i>The annual average (µg/mc)</i>			
			2008	2009	2010	2011
SB 1 Urban background Sibiu Hipodromului Street	SO ₂	20	7.55	6.68	8.13	8.20
	NO ₂	40	35.43	23.66	14.44	11.94
	PM 2,5 Automat	25-30	-	20.2	18.82	2.39
	PM 2,5 Gravimetric	25-30	-	-	6.9	23.74
	PM 10 Automat	40	23.72	-	-	14.44
	PM 10 Gravimetric	40	-	-	-	37.22
	CO mg/mc	10	0.57	0.37	0.34	0.63
	OZON	180-240	40.04	39.75	45.84	42.80
	BENZEN	5	-	2.32	2.32	3.86
SB 2 Industrial Sibiu Oțelarilor Street	SO ₂	20	7.59	5.22	6.00	6.09
	NO ₂	40	20.41	13.27	16.96	19.00
	PM 10 Automat	40	44.49	18.74	12.39	19.09
	CO mg/mc	10	0.15	0.15	0.13	0.21
	OZON	180-240	55.37	59.11	41.77	21.50
	BENZEN	5	-	1.68	2.17	4.19

Adapted after Sibiu Regional Environment Protection Agency's, Annual Report on the State of the Environment in Sibiu County for 2008, 2009, 2010 and 2011; page 12-18. [13]

The recorded value of the monitored pollutants can be considered directly proportional to the number of business operators in the sense that it decreases from 2008 the year considered the peak of post-December economic development (9043 businesses) until 2010 (8910 businesses) as shown in Table 2. What should be pointed out is that the recorded value

* According to Law 104/2011

of the monitored pollutants in the period did not exceed the limit values for each of them (Table 3).

At the level of the enterprise it is important to permanently analyze in detail the efforts and the obtained impact concerning volume and structure, namely social importance and importance of enterprise activity upon the environment (Grigorescu and Balan, 2013). The company operates in an environment characterized by economic and social dynamism and uncertainty [6].

CONCLUSIONS

The strategic options proposed in this study may contribute in the future to both improving the population's quality of life and also to the integrated sustainable development of Sibiu.

The economic activities in Sibiu city record a positive evolution (with some exceptions) in the sense of their development and their diversification in terms of ensuring the balance between economic growth requirements and the resources of the environment by minimizing the environmental damage.

A component of the concept of integrated sustainable development is the control over the impact of socio-economic activities on the environment.

Balanced economic development, coupled with the expansion of media and information in creating networks and partnerships between public institutions, businesses and universities can be achieved by the strategic management approach of the process of adopting the most relevant strategies for integrated sustainable development.

The study highlights the positive development in the city of Sibiu, for the values of the monitored pollutants recorded by the continuous monitoring system of air quality. In the period of our analysis the recorded values of monitored pollutants did not exceed the limit values for each of them.

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STUDIES CONCERNING THE POD DIMENSIONS VARIABILITY WITHIN A LANDRACES COLLECTION OF CLIMBING BEANS (*PHASEOLUS VULGARIS* VAR. *COMMUNIS*)

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Abstract

The study was aimed at determining the variability of pods dimension to a landraces collection of climbing beans in order to find populations which can be used in selection programs or as genitors in hybridization programs. The biological material was composed of 56 climbing beans landraces collected of western Romania and two varieties: Aurie de Bacău and Juliska. The study was conducted in a collection experience, organized in three repetitions. The experimental data were obtained by biometric measuring. The statistical analysis was performed by analysis of variance. The length and width of the pods show a great variability in the collection. The measurements were carried out on representative samples of each repetition. Compared to the control (Aurie de Bacău), many populations are at its value. Only two populations had significantly longer pods. For the pod width, the most valuable populations are at control value. In the collection are populations who may be processed by selection in order to obtain new varieties grown for pods, for growing in areas of origin.

Key words: variability, climbing beans, landraces, pod dimensions

INTRODUCTION

The beans are the main source of protein in human food in many developing countries. The protein in beans is very valuable in terms of quality, containing most of the essential amino acids.[6] The consumption of beans is different from country to country. In developed countries, is greater the pods consumption compared with the grains. [1] The green pods contain less protein, but are rich in carbohydrates, minerals and vitamin C [3]. For breeding, a category extremely valuable is represented by large number of landraces existing worldwide, but also in Romania. Growing a long time led to the homogenization of these populations. These forms can be used to improve the productivity. [7] [9]

Studies on the production capacity were made more in terms of number pods and grains per plant, to beans for grains. The dimensions of the pods have been less studied.[10] Many studies are conducted on dwarf beans, which is more extensive in culture, compared to climbing forms.[8]

Considering that bean is self-pollinating plant, the processing of landraces can be made by selection. The literature presents different strategies for selection implementing.[11] Another way of capitalizing on landraces is the use as genitors in hybridization programs. Many populations are valuable for a small number of characters and cannot be processed by

selection. The landraces are mentioned as sources of genes for the pods size increase.[5] The germplasm exploration is very important because, the success for use for the breeding is dependent on genetic determinism of characters. It is noted that from the genotype to the other, the determinism of characters that perform the plant productivity, is different. [4]

MATERIAL AND METHODS

The study aimed at assessing a landraces collection of climbing beans in respect of some character components of production capacity. Have been studied the length and width of pod, as benchmarks to beans grown for pods. Based on results can make recommendations on using this material in the breeding process.

The study was conducted in a type collection experience, organized in three repetitions, during three experimental years. The experimental data were obtained by biometric measurements. The experimental data processing was done by analysis of variance.[2]

The biological material included 58 genotypes, of which 56 landraces and two varieties: Aurie de Bacău (Romania) and Juliska (Hungary). The landraces have originated in western and southwestern Romania: Timiș, Arad, Bihor, Caraș Severin and Mehedinți counties

RESULTS AND DISCUSSIONS

Were evaluated the pods dimensions, being the important morphological characters to beans grown for pods.

The study of variance analysis in the experience shows that the length of the pods has varied, mainly due to the genotypes. Although from the one year to another they were observed variations of this character, the influence of experimental years is not significant. F test shows significance only for populations, but not for years but not for years (table 1)

The width of the pods is an important character to beans grown for pods, the long and wide pods are highly valued by consumers. The study of variance analysis for pods width shows that this character is decisively influenced by genotype, being a relative stable character from the year to year. F-test shows a distinct significant influence from population and a weak influence from experimental years (table 1)

Table 1

Variance analysis in climbing bean landraces

Source of variation	SS	DF	MS	F test
Pod length				
Total	19736.48	173		
Years	8.91	2	4.45	2.22
Populations	19498.91	57	342.09	170.54**
Error	228.67	114	2.01	
Pod width				
Total	204.02	173		
Years	0.06	2	0.03	1.23
Populations	201.24	57	3.53	147.72**
Error	2.72	114	0.02	

Average values highlight several populations as valuable for the pod length (table 2). The maximum average value was found to Sacu landrace, it showing constantly high values for this character. The average value of the length of the pod in this population was 18.74 cm. The Vânători population, which in two years was located at the minimum, for experimental cycle no longer, appears in the same position. After the experimental average cycle, the minimum average value for this character was observed in the population Joia Mare 2 (2.87 cm). This character variability from one year to another has been reduced, in a few cases; the coefficient of variation is greater than 10. The greatest variability was found in the Vânători population.

Aurie de Bacău variety, used as control, has achieved an average value for pods length of 15.97 cm, value significantly exceeded by Sacu and Julița 3 populations, these are the only situations of statistical assurance for positive differences. After the averages established during the experiment, are classified as worthless populations for pods length: 6 populations with significant assurance, 9 populations with distinct significant assurance and 12 populations with very significant assurance. Juliska variety was distinct significantly inferior to Romanian variety Aurie de Bacau. However, we consider valuable collection by populations that are superior to the control, even if they are less.

The analysis averages for the width pod it highlights the fact that the Aurie de Bacău is a variety that has a wide pod. The average 1.77 cm it ranks first in the ranking of variants for this character. The minimum value is present to Vinga 3 population that in all the years had the narrowest pods. Average values close to those of the control variety had the populations Târcaia 3, Orțișoara, Pietrani, Vânători, but also Juliska variety. (Table 2)

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From one year to another, the variability was reduced to the vast majority of the tested variants, but there are some with major fluctuations. Thus, the coefficients of variation and reaching values over 20, the maximum being 28.75 to Tărcaia 3 population.

Aurie de Bacău is the variety the the widest pods from the studied collection, all variants showing negative differences towards it, of which there for 49 are statistical assurance. This certifies that width pods, the landraces collected are inferior of control variety. Only a few are at the control level: Pietrani, Vânători, Tărcaia 3 but also Juliska variety.

Table 2

The significance of differences between studied climbing bean landraces

No	Genotype	Pod length(cm)			Pod width (cm)		
		$\bar{x} \pm s_x$	$s\%$	Significance of difference	$\bar{x} \pm s_x$	$s\%$	Significance of difference
1	Aurie de Bacău (Co)	15.79±0.13	1.41	Control	1.77±0.01	0.65	Control
2	Tărcaia 1	8.73±0.13	2.51	-7.06 ⁰⁰⁰	1.03±0.04	7.26	-0.74 ⁰⁰⁰
3	Tărcaia 2	16.17±.60	6.40	0.38	1.32±0.03	4.55	-0.45 ⁰⁰⁰
4	Julita 1	13.79±.18	2.27	-2.00	1.27±0.02	2.40	-0.50 ⁰⁰⁰
5	Julita 2	16.75±1.31	13.55	0.96	1.45±0.12	14.91	-0.33 ⁰⁰
6	Julita 3	18.27±0.76	7.25	2.48*	1.21±0.03	4.17	-0.57 ⁰⁰⁰
7	Vinga 1	14.25±0.98	11.91	-1.54	1.56±0.22	24.88	-0.21
8	Vinga 2	12.02±0.50	7.23	-3.77 ⁰⁰	1.06±0.01	0.32	-0.71 ⁰⁰⁰
9	Secusigiu	14.90±0.49	5.67	-0.89	1.37±0.04	4.70	-0.41 ⁰⁰
10	Buteni 1	16.60±0.35	3.67	0.81	1.46±0.10	12.31	-0.31 ⁰
11	Păulean 1	14.09±1.23	15.10	-1.70	1.24±0.03	4.45	-0.54 ⁰⁰⁰
12	Păulean 2	13.83±0.78	9.75	-1.96	1.67±0.06	6.61	-0.11
13	Sebiş 1	15.79±0.61	6.71	0.00	1.38±0.01	0.42	-0.40 ⁰⁰
14	Olari 1	12.92±0.77	10.39	-2.87 ⁰	1.12±0.06	8.92	-0.65 ⁰⁰⁰
15	Olari 2	17.33±0.12	1.20	1.54	1.38±0.07	9.05	-0.39 ⁰⁰
16	Bata	12.33±1.22	17.12	-3.46 ⁰⁰	1.31±0.06	7.97	-0.46 ⁰⁰⁰
17	Birchiş 1	14.01±1.07	13.27	-1.78	1.40±0.10	12.45	-0.37 ⁰⁰
18	Birchiş 2	15.74±0.97	10.67	-0.05	1.38±0.19	24.42	-0.40 ⁰⁰
19	Oţelu Roşu 1	13.26±0.86	11.23	-2.53 ⁰	1.20±0.08	11.16	-0.57 ⁰⁰⁰
20	Oţelu Roşu 2	16.13±0.39	4.17	0.34	1.62±0.06	6.05	-0.15
21	Oţelu Roşu 3	13.46±0.66	8.47	-2.33 ⁰	1.39±0.07	9.27	-0.39 ⁰⁰
22	Caransebeş 3	11.14±0.07	2.49	-4.65 ⁰⁰⁰	1.25±0.03	3.34	-0.53 ⁰⁰⁰
23	Orţişoara	15.36±0.30	3.42	-0.43	1.73±0.11	10.91	-0.04
24	Semlac	9.92±0.25	8.56	-5.87 ⁰⁰⁰	1.10±0.00	10.35	-0.67 ⁰⁰⁰
25	Tărcaia 3	14.66±0.95	25.98	-1.13	1.71±0.40	28.76	-0.07
26	Voiteg 1	14.49±0.42	8.64	-1.30	1.57±0.25	16.60	-0.20
27	Voiteg 2	12.26±0.27	7.17	-3.53 ⁰⁰	1.53±0.17	12.05	-0.24
28	Ioniş 1	14.13±0.21	5.36	-1.66	1.13±0.05	4.93	-0.64 ⁰⁰⁰
29	Becicherecu Mic	9.79±0.66	11.68	-6.00 ⁰⁰⁰	0.99±0.01	1.75	-0.78 ⁰⁰⁰
30	Bobda	14.93±0.57	6.60	-0.86	1.24±0.08	11.17	-0.53 ⁰⁰⁰
31	Ioniş 2	13.54±0.22	2.82	-2.25	1.47±0.01	157	-0.30 ⁰
32	Beiuş	14.49±0.28	3.38	-1.30	1.29±0.15	19.80	-0.49 ⁰⁰⁰
33	Fiziş 1	16.39±0.16	1.65	0.60	1.52±0.02	2.63	-0.25 ⁰
34	Fiziş 2	14.56±0.36	9.48	-1.23	1.31±0.09	8.39	-0.46 ⁰⁰⁰
35	Pocola 1	14.59±0.07	1.83	-1.20	1.42±0.07	5.72	-0.35 ⁰⁰
36	Pocola 2	15.54±0.21	5.35	-0.25	1.24±0.04	3.63	-0.53 ⁰⁰⁰

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37	Pietrani	12.24±0.35	10.93	-3.55 ⁰⁰⁰	1.71±0.41	27.45	-0.06
38	Vânători	10.22±1.12	44.58	-5.57 ⁰⁰⁰	1.73±0.20	13.37	-0.04
39	Buteni 2	13.15±1.04	29.12	-2.64 ⁰	1.40±0.03	2.30	-0.38 ⁰⁰⁰
40	Buteni 3	10.23±0.17	6.72	-5.56 ⁰⁰⁰	1.00±0.02	3.46	-0.77 ⁰⁰⁰
41	Bârsa	12.44±0.52	12.31	-3.35 ⁰⁰⁰	1.04±0.02	2.01	-0.74 ⁰⁰⁰
42	Cornereva	9.10±0.49	16.49	-6.69 ⁰⁰⁰	1.48±0.28	18.72	-0.29 ⁰
43	Bolvasnița	10.90±0.27	8.07	-4.89 ⁰⁰⁰	1.47±0.15	10.41	-0.31 ⁰
44	Șvinița	14.08±0.78	15.11	-1.71	1.24±0.14	12.38	-0.54 ⁰⁰⁰
45	Begheiu Mic	12.79±0.92	22.79	-3.00 ⁰	1.31±0.07	6.37	-0.47 ⁰⁰⁰
46	Carasova	10.72±0.02	0.79	-5.07 ⁰⁰⁰	1.60±0.03	2.20	-0.18
47	Joia Mare 1	14.16±0.04	1.07	-1.63	1.13±0.02	2.34	-0.64 ⁰⁰⁰
48	Joia Mare 2	8.27±0.08	3.16	-7.52 ⁰⁰⁰	0.92±0.02	2.17	-0.85 ⁰⁰⁰
49	Vinga 3	10.60±0.05	1.66	-5.19 ⁰⁰⁰	0.81±0.03	3.27	-0.96 ⁰⁰⁰
50	Nadab	12.20±0.09	2.05	-3.59 ⁰⁰⁰	0.99±0.03	2.67	-0.78 ⁰⁰⁰
51	Sebiș 2	16.62±0.09	1.77	0.83	1.45±0.01	0.79	-0.32 ⁰
52	Vălișoara 1	15.18±0.10	2.28	-0.61	1.65±0.01	0.70	-0.13
53	Vălișoara 2	13.43±0.06	1.74	-2.36 ⁰	1.51±0.03	2.03	-0.27 ⁰
54	Caransebeș 1	12.32±0.12	3.71	-3.47 ⁰⁰⁰	1.03±0.01	0.97	-0.74 ⁰⁰⁰
55	Caransebeș 2	11.15±0.26	8.51	-4.64 ⁰⁰⁰	0.99±0.01	1.16	-0.78 ⁰⁰⁰
56	Sacu	18.74±0.14	2.68	2.95*	1.64±0.02	1.27	-0.14
57	Juliska	12.54±0.06	1.69	-3.25 ⁰⁰⁰	1.73±0.03	1.77	-0.05
58	Făget	12.35±0.03	1.05	-3.44 ⁰⁰⁰	1.28±0.02	1.97	-0.50 ⁰⁰⁰
Experiment average		13.54±0.31	17.52		1.35±0.24	17.73	
		DL _{5%} = 2.29 cm DL _{1%} = 3.04 cm DL _{0,1%} = 3.92 cm		DL _{5%} = 0.25 cm DL _{1%} = 0.33 cm DL _{0,1%} = 0.43 cm			

The grouping variants as average values for the period of experimentation highlight the value of the collection. The variability in the collection is large, but the number of variants the very long pods, is reduced. Over 60% of collection variants had pods with lengths between 12 and 16 cm. Values between 16 and 18 cm were present at 7 populations (12.06%), but very high values, over 18 cm were present only to two populations (3.44%), but very high values, over 18 cm were present only to 2 populations (3.44%), respectively Sacu and Julita 3. According to these data, we consider the collection valuable and useful for breeding process. The reduced intrapopulation variability and the stability of this character, especially to populations in with high values, it recommends these as valuable, even can be processed directly by selection. Sure they can be used as genitors. Aurie de Bacău variety, although it is an old variety, is valuable, having long pods, being superior in this viewpoint compared to the variety Juliska. (Figure 1)

The grouping variants of experience after average of the width pods shows that there is a important variability, but the maximum value of this character is present to Aurie de Bacău variety. The collected populations had lower values for this character. The most variants presented width pods between 1.30 and 1.60 cm (39.65% of collection). The group with high values, with averages between 1.60 and 1.90 cm, includes 11 variants (18.96%), in

this group and two varieties being included by Bacau and Juliska Golden, in this group being included the two varieties Aurie de Bacău and Juliska, but also Pietrani, Vânători, Târcaia 3 genotypes. Given that a large pods width must be present to the form with long pods, is found that in the collection, the forms with the longest pods are acceptable widths, which recommends again as a initial material for the breeding process. (Figure 2)

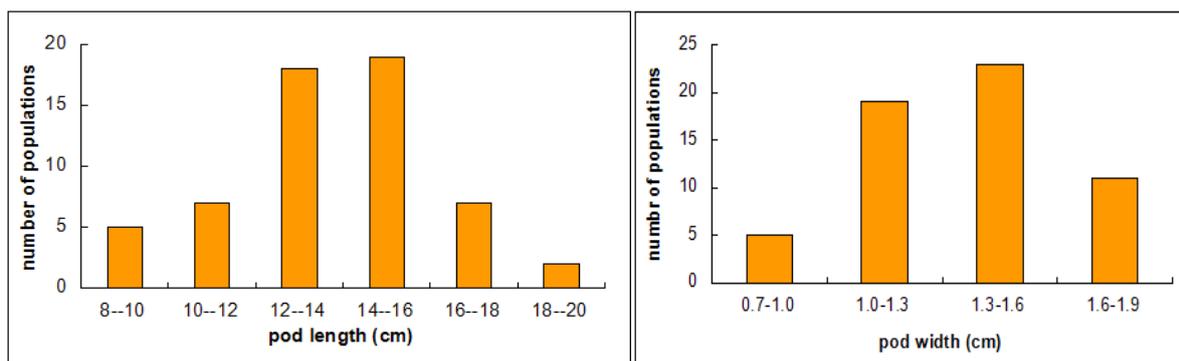


Figure 1 Results regarding pod length in climbing bean landrace collection

Figure 2. Results regarding pod width in climbing bean landrace collection

CONCLUSIONS

The collection studied is important in terms of variability of component characteristics of plant productivity.

The length of the pods was decisively influenced by genotype. Aurie de Bacău variety was significantly exceeded by Sacu and Julita 3 landraces. These genotypes are recommended to be used as initial material in breeding of pods length, either by applying selection, either as genitors.

The width of the pods is a stable character from one year to another. Aurie de Bacau is the genotype with the widest pods from the studied collection. Most populations are below its. At the level they are the populations Pietrani, Vânători, Tarcaia 3.

The genotypes with long pods they also have the pods with acceptable width, it is precious for the process of breeding.

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PRODUCTIVE PERFORMANCES ANALYSIS OF FRĂSINET CARP FOR CONSUMPTION

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Abstract

*The aim of the study was to analyze the growth performance of the Frăsinet summer II and III carp in monoculture and polyculture, along with silver carp (*Hypophthalmichthys molitrix*) and crucian carp (*Carassius gibelio*), in a systematic fish unit. In summer II, the highest values of growth intensity and body weight in fish harvest, were recorded in the years that polyculture was practiced (in 2011, in BC 1 pond the individual body weight of fish grew 14 times and by fall reaching 1400 g/fish, following an average gain of 7.2 g/day; in 2009, in BC 2 pond, individual body weight has increased 16 times, up to 800 g/fish, with an increase of 4.2 g/day), and lowest results were recorded in 2010, when monoculture of Frăsinet carp was practiced (in pond BC 2 body weight increased 9.5 times and it was reached 620 g/fish, with an increase of 3.1 g/day).*

On fishing harvest Frăsinet summer III carp realized the maximum growth intensity and body weight in 2010 (final weight of 4200 g/fish), as against to 3800 g/fish in 2009 and 3500 g/fish in 2011.

The somatometry results were favorable to Frăsinet summer III carp: total body length 65.13 cm (+16.9 cm against the Frăsinet summer II carp), standard length 53.13 cm (+13.9 cm), body maximum height 26.14 cm (+9.5 cm) body highest perimeter 50.11 cm (+12.8 cm) body thickness 22.98 cm (+11.7 cm), body weight 3.0 kg (+2.1 kg). Low values of heritability coefficient (under 10%) for most somatic traits analyzed, shows a good homogeneity of the herd looked with an important influence on fish production. Body indices values show good body proportionality, proper massiveness, well developed muscles and intense rhythm of growth both in Frăsinet summer II and III carp.

Keywords: Frăsinet carp, growth intensity, body weight, body measurements, body indices.

INTRODUCTION

By artificial selection of common carp (*Cyprinus carpio*) and improving growth conditions (rational feeding, ensuring optimal levels of physical and chemical parameters of aquatic environment etc.) there were achieved improved breeds and populations, known as "culture carp". One of the local improved populations, appreciated by cyprinids breeders because of its productive performance is Frăsinet race, and it will be covered by this study. High intensity growth, which causes shortening the production cycle, efficient use of natural biomass and supplemental food, great precocity and reproductive growth, high adaptive capacity, suitability to intensive rearing and producing hybrids and super-industrial interracial etc. are some of the bioproductive characteristics that justify the big interest of the cyprinids breeders in our country and other countries for Frăsinet carp (Bud I. et al., 2004; Grozea A., Bura M., 2002, 2008).

Depending on the applied exploitation technology, "consumption carp" is represented by the summer II carp (C₁₊) and summer III carp (C₂₊). In the case of summer II carp goes

through a single "hibernation" ("winter sleep"), and in the case of summer III carp, two winterings. Due to higher growth intensity, summer II carp exploitation ensures higher profitability than summer III carp, but the last category is better developed, offering consumers a greater amount of high-quality meat (Bud I. et al., 2004; Diaconescu Șt., 2003; Grozea A., Bura M., 2008).

MATERIAL AND METHODS

The research was performed in an intensive fish farm in the south part of the country, focusing on consumption fish production and populating biological material (juveniles summer I and II), fishing and marketing of fresh fish from local Frăsinet breed.

The purpose of the study was to analyze over three years the monoculture and polyculture growth performances of Frăsinet summer II and III carp with species of Asian cyprinids acclimatized in our country (silver carp, crucian carp).

In 2009 and 2010, summer II carp growing was done in BC 2 pond, with area of 6 ha and BC 4 pond (3.8 ha), and in 2011 in BC 1 pond (2.7 ha). In 2009 and 2011 polyculture was practiced (in 2009 Frăsinet carp and silver carp; in 2011, Frăsinet carp, crucian carp and silver carp), and in 2010 monoculture (only Frăsinet carp). Regardless of the year (2009, 2010, 2011), growing of Frăsinet summer III carp was performed in the pond no. 5 (BC 5), with an area of 28.5 ha in polyculture, along with silver carp and crucian carp.

To track the health condition of the fish and the manner of food recovery reflected by the growth intensity and body weight achieved at different ages, during the growth of material fisheries summer II and III, periodically, about 2 weeks, control fishing was carried in different areas of the ponds. From each pond were caught a number of 100-150 fish, which were weighed, their body condition was assessed and there have been shown any behavioral changes and/or clinical signs of disease. During control fishing conducted in August, 2011, on 50 fish of Frăsinet summer II and III carp, there were performed the main body measurements (Lustun L., 1985; Bud I., Vlădău V., 2004; Turliu N., 2008), and using the values obtained were calculated main body indexes (Bud I., Vlădău V., 2004).

For the morphological and growth performance assessment of biological material analyzed it was necessary to apply somatoscopy, gravimetry and somatometry. The primary data obtained by applying the working methods previously mentioned, were statistically processed (population statistics were calculated - mean, variance, standard deviation, standard

error of the mean, variation coefficient - Tacu I. 1968; Sandu Gh., 1995; Neagu Iuliana, 2005).

RESULTS AND DISCUSSIONS

During the investigations, Frăsinet summer II carp presented an important growth intensity, namely:

- In 2009, the year in which it was practiced polyculture (Frăsinet carp + silver carp), accumulation of total body weight from pond populating to harvest fishing was 750 g/fish in pond BC 2 and 640 g in pond BC 4 (table 1). So, during the approx. 180 days, fish increased their body weight by approx. 16 and 12 times. Although the weight of fish was lower at populating the pond BC 2 to 10 g/fish, the final weight 100 g was higher due to better growth rate recorded over the entire period between populating ponds and harvest fishing. Given that in both ponds feeding was done with the same mixture feed, the difference is probably due to more favorable physical-chemical factors in fish breeding pond BC 2. Considering the initial and final weight and time of growth (180 days) results a daily average gain of 3.5 g/day in the pond BC 4 and 4.2 g/day in pond BC 2.

- In 2010, when Frăsinet carp was grown in monoculture, although higher intensity growth was recorded in pond BC 4 (from populating to harvest fishing, body weight increased approx. 14 times total - total growth gain 465 g/fish, against 9.5 times - total growth gain 555 g/fish in pond BC 2), final weight was lower with 120 g/fish, because of higher weight (almost double) of fish, at the time of populating pond BC 2 (table 1). Average daily gain in of growth in pond BC 2 was 3.1 g/day and 2.6 g/day for pond BC 4.

- In 2011, polyculture was applied in all three pools: Frăsinet carp + silver carp in BC 1 and BC 2, Frăsinet carp + silver carp + crucian carp in pond BC 4. Analyzing the data presented in Table 1, it shows that, the greater weight to the populating and the final growth of summer II had the fish reared in the pond BC 1 (100g or 1400g/fish) that, within the populating ponds - autumn fishing had a very intense growth rate (body mass increased by 14 times).

The other two pools (BC 2 and BC 4), although at the populating ponds fish weight was the same (60 g) at the end of growth, the individual weight was different, in behalf of fish reared in pond BC 4. The result is explained by the higher growth rate recorded at each control fishing in this pond. From populating ponds to autumn fishing, average daily gain was about 7.2 g/day in BC 1, 5.2 g/day in BC 4 and 3.7 g/day in BC 2.

The best results of Frăsinet summer II carp on the growth intensity and body weight achieved at harvest fishing, were obtained in the years that polyculture was practiced (2011 followed by 2009) and the minimum results was recorded in 2010, the year that monoculture was applied.

In 2011, corresponding the maximum productive performance, body mass accumulation and the best growth rate were found in pond BC 1 followed by pond BC 4.

Table 1

Weight dynamics of Frăsinet carp in summer II

Fish pond	Introduction to pond	Data of control fishing and fish weight (g/fish)							Fishing harvest (g)
		18.06.2009	08.07.2009	24.07.2009	15.08.2009	29.08.2009	10.09.2009	-	
BC 2 -6,0 ha-	07.04.09 50 g	150	210	280	400	600	700	-	800
BC 4 -3,8 ha-	06.04.09 60 g	180	200	250	350	500	580	-	700
		10.07.2010	17.07.2010	24.07.2010	31.07.2010	14.08.2010	28.08.2010	12.09.2010	-
BC 2 -6,0 ha-	10.04.10 65 g	150	200	300	320	450	500	600	620
BC 4 -3,8 ha-	23.03.10 35 g	100	150	200	250	300	400	450	500
		20.06.2011	12.07.2011	29.07.2011	12.08.2011	30.08.2011	25.09.2011	-	-
BC 1 -2,6 ha-	27.04.11 100 g	350	500	800	1000	1200	1300	-	1400
BC 2 -6,0 ha-	25.04.11 60 g	250	370	450	500	550	600	-	650
BC 4 -3,8 ha-	10.04.11 60 g	300	450	650	800	900	1000	-	1100

The results are comparable to those reported in the literature by various authors, who analyzed the productive performance of Frăsinet carp. Thus, Nicolae Carmen (2004) states that, according to the abundance of natural food and supplemental feed, on harvest fishing conducted in the autumn, at the end of the second summer growth, Frăsinet carp achieves weights from 400-1600 g/fish and in special growth conditions, even 2330 g/fish.

Analysis of the results regarding the growth dynamics of the intensity of Frăsinet summer III carp (Table 2) suggests the following:

- In 2009, the total average increase growth from populating the pond to harvest fishing was about 3200 g/fish in pond BC 5 (Table 2). Therefore, during the growth, from ponds populating to harvest fishing, Frăsinet summer III carp has increased the body weight

of approx. 6.33 times. Increase growth was increased with age, the maximum growth intensity was recorded in July and August, during which juvenile doubled its weight.

- In 2010, the populating weight was higher than in 2009 with approx. 150 g/fish, which resulted in higher individual weights at the end of growth, namely the time of the harvest fishing. The total average increase growth from populating ponds to depopulation, was 3450 g/fish, therefore, the fish have increased 5.6 times body weight. The intensity increased with increasing age, the maximum increase being registered in July (about 500 g/fish) (Table 2).

- In 2011, the initial weight of individual fish at the time of populating the pond BC 5 was about 1.1 times lower than in 2009 (-50 g/fish) and approx. 1.4 times compared to 2010 (-200 g/fish). Therefore, the results obtained at the end of growing depended to this factor, the total body weight accumulation was 2950 g/fish (Table 2), lower by approx. 850 g compared to that recorded in 2009 and 500 g compared to the growth rate established for 2010. In other words, in 2011, the body weight of Frăsinet summer III carp increased about 6.4 times at the end of the fattening period, compared to the individual weight at populating of biological material in pond BC 5. The strongest growth was recorded in control fishing conducted in June-July (650-700 g/fish).

Table 2

Weight dynamics of Frăsinet carp in summer III

Fish pond	Introduction to pond	Data of control fishing and fish weight (g/fish)							Fishing harvest (g)
		18.06.2009	08.07.2009	24.07.2009	15.08.2009	29.08.2009	10.09.2009	-	
BC 5 -28,5 ha-	06-10.03.09 600 g	1100	1300	2200	2700	3300	3500	-	3800
		10.07.2010	17.07.2010	24.07.2010	31.07.2010	14.08.2010	28.08.2010	12.09.2010	-
BC 5 -28,5 ha-	09.03.10 750 g	1500	2000	2700	3200	3300	3600	4000	4200
		20.06.2011	12.07.2011	29.07.2011	12.08.2011	30.08.2011	25.09.2011	-	-
BC 5 -28,5 ha-	22-31.03.11 550 g	1500	2200	2700	3000	3100	3300	-	3500

In an intensive fish unit, by applying additional feeding to Frăsinet carp, at the end of summer III, Nicolae Carmen (2004) sets average weights between 3200-4300 g, significantly close values corresponding to Frăsinet carp population analyzed in this study. The study results are superior to those provided by Grozea A. and Bura M. (2008), which determine the

average weight of Frăsinet carp at the age of three summers of 0.8-1.9 kg, 1.0-1.2 kg for Moldova-Podul Iloaiei carp and 2.5 kg for Lausitz, Galiția and Eischgründ breeds.

Improving productive performance of fish requires also appreciation of somatic characteristics positively correlated with fisheries production (Cristea Viorica, 1995; Vlaic A., 2007). For this purpose, fishery inspection in August 2011 on 50 fish Frăsinet summer II carp and 50 fish summer III were performed by applying body measurements and somatometric results and the main body values indexes are shown in tables 3, 4.

Towards mid-August, the 50 Frăsinet summer II carp had presented an total average length of approx. 48 cm and standard length of approx. 39 cm, then the ratio of these two dimensions is approx. 1.2/1.0. The same report size is maintained for summer III carp, but in value terms, the results are higher (total length approx. 7 cm, and the standard length approx. 14 cm). In both age groups, the standard length is approximately 81.5% of the total.

For sport fishing the interest is also for statutory and commercial lengths, which are included in the total length of 1.1-1.3 times Frăsinet two summers carp and 1.3-1.4 times at three summers carp. And if these somatometric qualities, summer III carps are higher by approx. 7-10 cm. Percentage of the total length, the length is 88.1% statutory summer II carp and 75.5% in summer III carp.

The minimum and maximum height of the body also showed maximum values for Frăsinet summer III carp (26.2 cm versus 16.6 cm, 10.1 cm versus 8.0 cm respectively). This superiority is normal because, with age youth all increase body size, including depths (heights), up to the somatic maturity. In relative values, the maximum height holds approximately 34.5% of total body length, at summer II carp about. 40.1% carp for three summers, and the lowest, 16.7% and 15.5%. In absolute terms, between the maximum height and overall length, there is the ratio of 1 to 2.9, for two summers carp and 1 to 2.5 at three summers carp.

In a study on the main phenotypic characteristics of carp Frăsinet, Stan T. (1986), establishes that the total length of the body, maximum and minimum heights are 44.3% and 17.9% in the form of scales and 42, 1%, respectively 15.2% from variety without scales. The parallels between these values and the results shown in Table 3, there are no differences between the population of Frăsinet carp analyzed by the previously mentioned analyzed in this study.

Analysis of the two perimeters (large and small) and thickness trunk, suggests developing proper depths, widths, and muscle, which gives the characteristic appearance of a

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rounded body (globular). The results are favorable all Frăsinet summer III carp (large perimeter + approx. 13 cm, small perimeter + approx. 10 cm, thick body + approx. 12 cm). For this age group, comparing the three-dimensional total body length show that large perimeter sea includes the total length of about 1.3 times (ratio of 1/1.3), the small perimeter than 2.1 times (1/2,1), 2.8 times the thickness of the trunk (1/2.8).

Table 3

Main body dimensions values of Frăsinet carp summer II and III

Analyzed feature	Statistical parameters analyzed					
	Mean	Diference (cm) *	Standard error	Variance	Standard deviation	Coefficient of variation
Total length trunk (cm)	48,19	-	0,09	0,43	0,65	1
	65,13	+16,9	0,15	1,17	1,08	2
Standard length trunk (cm)	39,27	-	0,11	0,61	0,78	2
	53,13	+13,9	0,15	1,17	1,08	2
Length statutory (cm)	42,47	-	0,09	0,49	0,7	2
	49,16	+6,7	0,14	1,07	1,03	2
Commercial length (cm)	37,20	-	0,15	0,49	1,12	3
	47,13	+9,9	0,15	1,17	1,08	2
Minimum height trunk (cm)	8,04	-	0,04	0,12	0,34	4
	10,11	+2,1	0,15	1,25	1,11	11
Maximum height trunk (cm)	16,61	-	0,07	0,26	0,50	3
	26,14	+9,5	0,15	1,20	1,09	4
Large perimeter trunk (cm)	37,32	-	0,16	1,33	1,15	3
	50,11	+12,8	0,15	1,25	1,11	2
Small perimeter trunk (cm)	20,20	-	0,21	1,24	1,54	8
	30,35	+10,2	0,14	1,04	1,02	3
Thick trunk (cm)	11,33	-	0,13	0,96	0,97	9
	22,98	+11,7	0,14	1,08	1,04	5
Caudal peduncle length (cm)	9,26	-	0,10	0,53	0,72	8
	11,16	+1,9	0,03	0,05	0,23	2
Head length (cm)	10,1	-	0,06	0,23	0,47	5
	11,6	+1,5	0,06	0,18	0,43	4
Dorsal fin length (cm)	8,16	-	0,04	0,12	0,34	4
	12,73	+4,6	0,12	0,78	0,88	7
Length of ventral fin (cm)	8,04	-	0,04	0,14	0,37	5
	9,98	+1,9	0,07	0,24	0,49	5
Anal fin length (cm)	5,5	-	0,06	0,22	0,46	8
	5,94	+0,4	0,02	0,03	0,17	3
Caudal fin length (cm)	9,92	-	0,04	0,12	0,34	3
	11,97	+2,1	0,08	0,32	0,57	5
Body weight (kg)	0,90	-	0,02	0,04	0,2	2
	3,00	+2,1	0,009	0,24	0,50	14

*The values correspond to Frăsinet summer III carp; * Plus the size and weight recorded to Frăsinet three summers carp versus the two summers carp.*

The average length of caudal peduncle was higher by about 1.9 cm (11.2 cm to 9.3 cm) to Frăsinet summer III carp and represented approx. 17% of the total body length of the

fish, 19.4%, resulting release of Stan T. (1986). Of fins, the longest is presented by the dorsal fin followed by caudal, ventral and anal.

Regarding the main productive feature, namely, body weight, average values registered in mid-August, 2011, were approx. 0.9 kg, to Frăsinet summer II carp and 3.0 kg for Frăsinet summer III carp (Table 3). The added production of approx. 2.1 kg average weight per fish recommends capitalizing Frăsinet carp for three summers consumption, age at offering consumers a greater quantity of meat with higher nutritional value. Weight of the fish continued to rise until the autumn fishing harvest, when the Frăsinet summer II carp increased in pond BC 4, reached an average weight of 1.1 kg/fish and Frăsinet summer III carp increased in pond BC 5 reached 3.5 kg.

For all analyzed body size, population of Frăsinet summer II and III carp, showed good homogeneity, as demonstrated by low values of the coefficient of variation (1-9%). Only for body weight, uniformity herd of summer III carp was medium.

Grozea A. and Bura M. (2008) established that by choice and by improving living conditions and feeding, carp culture exhibit a growth rate more intense than wild carp and as a result, at the age of three summers reach weights over 2.0 kilograms body, to approx. 0.64 kg. Bud I. et al. (2004), established the fishing harvest of 0.7-0.8 kg average weight for two summers carp culture and 1.2-1.5 kg for three summers. Stan T. (1986), argues that Frăsinet carp offers high quality meat and grow rapidly, so that after the second summer reach 0.3-0.4 kg, and after the third summer falls to 0.8 to 1.0 kg.

Compared with these results, high values of body weights recorded by the population studied, demonstrated on the one hand, the biological potential high of biological material analyzed, and on the other hand, rigorous implementation of technology growth (properly feeding, maintaining water quality, preventing disease by specific health measures, etc.).

The results are even higher average values characteristic improved breeds and populations of carp grown in our country. Moldova-Podul Iloaiei carp, increased in catchment area of Moldova usually reach 0.4-0.5 kg weights in the summer II and 1.0-1.2 kg in summer III and Lausitz and Eischgründ breeds, at three summers, reaching an average weight of 2.5 kg (Grozea A., Bura M., 2008).

Relationships analysis size of the main body dimensions expressed through body indexes (Table 4) suggests a good body and a high intensity proportional growth both in Frăsinet summer II and III carp. The high value of the index fattening (parameter that characterizes the existence of vital fish) set for Frăsinet three summers carp compared to two

summers (2.0% versus 1.5%) demonstrates growth in the basins of prey, which it allowed a growth rate intense proper development of body size and muscle torso. Thus, the index of the registered extra thickness of approx. 15 percentage points and carnosity index was lower by approx. 3.2 percentage points (Table 4). Therefore, in terms of fish production feasible, advisable capitalization of Frăsinet late summer III carp because weight is greater muscle mass is better developed, widths, depths, perimeters and thickness are higher. Thus, the index value of the thickness rapidly increases (43% to 28%), which demonstrates improving the fattening index of fish.

Bud I. and Vladău V. (2004) show that if culture carp, the biogenic capacity growth of ponds is good if fattening index is less than 1.8%. The same authors establish for Frăsinet carp 1.7-1.8 index profile, below the calculated for Frăsinet carp three summers population analyzed in this study. Nicolae Carmen (2004), said lower profile index values (1.62 to 1.84) than those obtained in this study.

Results on the values of body indices analyzed are close to those reported Bura M. et al. (1997) and Grozea A. et al. (2008) for the local population of improved Seleuş carp (the profile index - 2.27, the quality index - 1.08) and the population of carp Moldova-Podul Iloaiei (format index - 2.43). These two populations presented however higher values of the fattening coefficient (3.33, Seleuş carp 3.40, Moldova-Podul Iloaiei carp).

Table 4

The main body indexes values for Frăsinet carp summer II and III

Specification	Number of individuals measured	Body index value	
		Carp summer II	Carp summer III
Fattening Index	50	1,48%	2,00%
Profile Index	50	2,36	2,03
Quality Index	50	1,05	1,06
Thickness Index	50	28,00%	43,25%
Carnosity Index	50	25,00%	21,80%

CONCLUSIONS

1. The best results on the growth intensity and body weight achieved on fishing harvest for Frăsinet summer II carp were achieved in the years that was practiced polyculture (2011, pond BC 1 individual body mass increased 14 times, reaching in the fall 1400 g/fish, following an average gain of 7.2 g/day; in 2009, in the pond BC 2 individual weight has increased 16 times, up to 800 g/fish, with an increase of 4.2 g/day) and minimum results were recorded in 2010, when the increase was applied to Frăsinet carp in monoculture (in pond BC

2 weight increased 9.5 times, fish have reached 620 g/ fish at fishing harvest, with an increase of 3.1 g/day).

2. The biggest intensity of growth and weight were made by Frăsinet summer III carp at fishing harvest and it was obtained in 2010 (fish increased their individual body weight with 3450 g, about 5.6 times, reaching the final weight of 4200 g/fish), to 3800 g/fish in 2009 (+3200 g/fish, that increased body mass of 6.33 times) and 3500 g/fish in 2011 (2950 g/fish, increase of 6.4 times).

3. The somatometric results were favorable to Frăsinet three summers carp, for example: total body length of 65.13 cm (+16.9 cm to Frăsinet two summers carp), standard length of 53.13 cm (+13.9 cm), the maximum height of the trunk 26.14 cm (+9.5 cm), high perimeter of trunk 50.11 cm (+12.8 cm), trunk thickness 22.98 cm (+11.7 cm), weight body 3.0 kg (+2.1 kg).

4. Body indices values suggest a good body proportionality, pronounced massiveness, well developed muscles and intense rhythm of growth both in Frăsinet summer II and III carp.

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POTENTIAL OF RENEWABLE SOURCES IN ROMANIA

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Abstract

This paper presents the current and prospective situation regarding the use of renewable resources in Romania. Geographic position, all forms of relief are special characteristics of Romania, which, properly exploited, can lead to the almost integral use of solar, wind, hydraulic or geothermal energy. Countries with a high level of development receive about 80% of energy by conversion based on the different technologies of this type of primary energy resources.

Keywords: renewable energy, Romania, potential

INTRODUCTION

A non-renewable source is a natural resource that can not be produced, regenerated or reused within predictable deadlines in such a volume that it can sustain its consumption rate. Non-renewable energy sources are natural resources that require millions of years to form naturally and can not be replaced as quickly as they are consumed. Until recently, we can not imagine the contemporary industrial society without the use of non-renewable energy resources: coal, oil and natural gas.

Besides the fact that the non-renewable energy resources are limited, a big drawback is the pollution of the environment upon their burning. These were the main energy resources until the accession of Romania to the European Union. The only renewable source used until then was the hydraulic power (Hydropower Station at the Porțile de Fier and Hydro Power Plants on the Olt River). Now we are integrated into the European energy strategy program that targets the use of alternative energies as the main energy sources.

MATERIAL AND METHOD

The new global climate change agreement, the Paris Protocol, adopted in December 2015, formalizes the goal of a 40% reduction in greenhouse gas emissions by 2030 agreed at the European Council in October 2014. The main objectives of the current framework for energy and climate policy, to be achieved by 2020 are: 20% reduction in greenhouse gas emissions, 20% share of renewable energy and 39% increase in energy efficiency improvement programs by 20% . The current energy and climate policies have led to

substantial progress towards meeting the 20/20/20 targets. According to the Commission's estimates, greenhouse gas emissions will be reduced by 24% from 1990 levels by 2020 and 32% by 2030. Renewable energy is projected to increase further to 21% by 2020 and 24% in 2030.

According to solargis.info, the distribution of radiant energy in Europe is as follows:

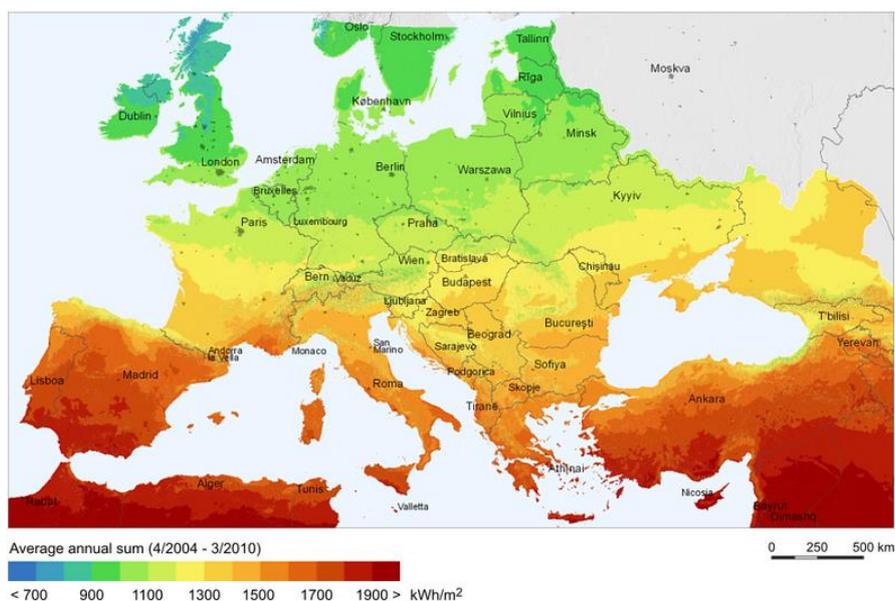


Fig. 1. Solar Radar Map of Europe (solargis.info)

Also, according to solargis.info, the distribution of radiant energy in Romania is as follows:

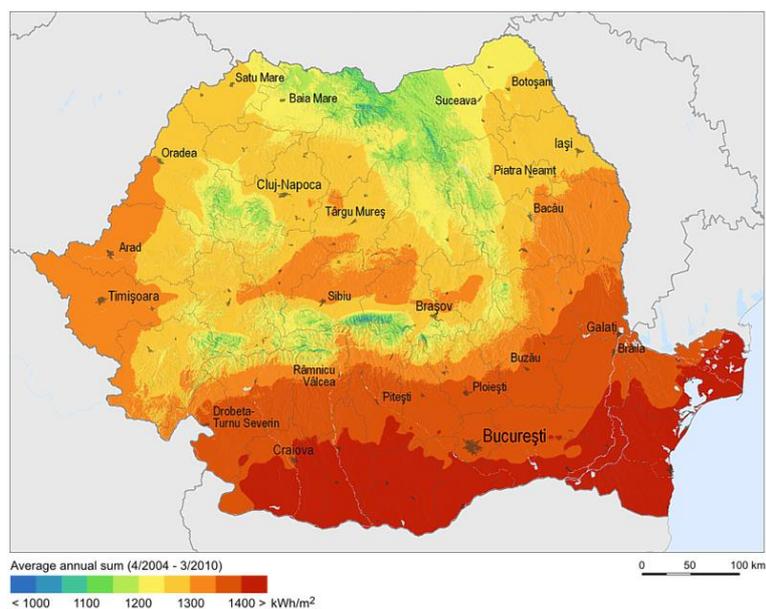


Fig. 2. Solar Radar Map of Romania (solargis.info)

Total power installed in the national energy system in 2015 was 24,540.77 MW, of which 6,435.20 MW in coal power plants, 5,561.81 MW in hydro power plants, 6,731.28 MW in hydro power plants, 1,413 MW in the power plant Nuclear power plants, 2,977.69 MW in wind farms, 120.68 MW in biomass plants and 1.301.06 MW in photovoltaic plants and 0.05 MW in geothermal plants. Romania's domestic electricity consumption in 2015 was 58,869 GWh with 1,955% higher than the 2014 figure (57,740 GWh).

Electricity production in 2015 was 65,598 GWh, of which 18,345 GWh produced in coal power plants, 9,399 GWh in hydro power plants, 11,638 GWh in the nuclear power plant, 16,622 GWh in hydro power plants, 7,062 GWh in wind power plants, 529 GWh In biomass plants and 2,003 GWh in photovoltaic power plants (Hidroelectrica, 2016).

RESULTS AND DISCUSSIONS

Both in Europe and in Romania, solar and wind power systems have been developed. The European energy trend is towards the production of energy from solar, wind and wind sources. Due to massive deforestation that has taken place over the last 20 years in Romania, the forest regeneration capacity can not keep up with the real use of biomass for energy purposes as long as wood is used for other purposes.

Geothermal energy can practically be used only in the Western Plain of Romania where geothermal water is very close to the surface. Deep drilling wells for heat capture through heat pumps due to extremely high drilling costs are not currently a viable option for the rest of the country.

Following the agreements concluded, it is planned to start the works at a new nuclear power plant in 2020. Even though this form of energy is considered clean, not affecting the environment (the carbon footprint is extremely small), however due to the radioactive waste that will accumulate in Time is not a perspective solution.

The current population of Romania is 18 million inhabitants. In 1990 it was 22 million. The demographic downward trend, strangely, by reducing the number of consumers gives Romania time to adopt alternative technologies. As such, according to the energy ministry communiqué, in 2016, the renewable energy target was set for 2018 (<http://energie.gov.ro/strategia-energetica-nationala/>). The wind power groups in Dobrogea and the rest of the solar energy groups installed throughout the country, through co-financing from European funds, Three years to overcome planned renewable energy production two years later.

CONCLUSIONS

Romania's solar, wind, hydro and geothermal energy potential is far from reaching its limits. According to the illustrations above, solar energy has a significant share in the southern area and in some low-altitude parts, which can become real energy forces not only for Romania and for Eastern Europe. Wind energy is distributed due to varying relief in equal measure as a share across the country. Energy groups using this type of energy can be installed not only in the Dobrudja area and in the Transylvanian Plateau and in all the plain areas.

At present, the hydropower system has a share in the national energy system that exceeds 30%, this is due to the large groups at the Iron Gates and the succession of hydropower plants on the Olt river. Romania with a large number of main rivers flowing through areas that allow the construction of dams and the installation of energy groups is an advantage.

In the last few years, even if the phenomenon of migration of a certain part of the population from the urban area to the rural area appears to be minor, it is still increasing. With this migration, there is the cultural transfer from city to village, which makes the latest technologies to be applied in the rural area as well. The wind or hydraulic power plants will progressively make their appearance in the urban area, adding this tendency to small, medium and large farms; some of Romania's electricity consumers will have independence from the national energy system. Increasing the importance of the rural area will bring a minus in national energy consumption that can be offset by energy exports.

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THE IMPORTANCE OF HUMIC SUBSTANCES IN AGRICULTURAL SYSTEMS

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Abstract

The natural fertility of soils has decreased in the last 20 years, due to intensive use of chemical fertilizers, which caused deterioration of physical, chemical and biological properties of soil. Therefore, is important the development of non-toxic, environment-friendly and economic fertilizers. Recently, the fertilizers based on humic substances have attracted attention because they increases productivity and fertility of soils, uptakes the mineral elements and promote the root length. Humic substances play an important role from agronomical perspective, being a major factor that improve soil characteristics, has a high cation exchange capacity, enhance water retention, increase seed germination rates. So far, there are many products that contain humic substances used for their growth-promoting effects, to increase productivity and yield.

Keywords: fertilizer, humic substances, organic matter.

Humic substances

The main components of soil organic matter that strongly influence soil fertility are humic substances that appear from decaying of plant tissues (Piccolo, 2001). Humic substances can be encountered in soils and in various concentrations in rivers, lakes, oceans, composts, sediments (Mayhew, 2004).

They constitute the stable fraction of soil organic carbon that resists microbial degradation due to their complex structure and to the ability to generate complexes with soil minerals (Billingham, 2012). They possess cation and anion exchange capacities that are exceeding those of clays (Mayhew, 2004).

Humic substances are major components of organic matter often constituting 60 to 70% and are considered as a key component of sustainable agricultural practices and terrestrial ecosystems since they control chemical and biological properties of the rhizosphere (Schnitzer et al., 1972; Stevenson, 1994; Tufail et al., 2014).

Humic substances vary in composition depending on their source, location, and method of extraction. Humus at the bottom of dams or lakes is mostly humic acid that

precipitated. Fulvic acid on the other hand, can reach high concentrations in solution in poorly drained areas such as bogs and swamps and can sometimes be seen in streams where the water colour would be brown but clear. Humus from geological deposits such as black coal when oxidized, brown coal or lignite is composed of high humic acid but low fulvic acid contents due to leaching (Malan, 2015).

The range of the elemental composition of humic materials is relatively narrow, being approximately 40-60% carbon, 30-50% oxygen, 4-5% hydrogen, 1-4% nitrogen, 1-2% sulfur, and 0-0.3% phosphorus (MacCarthy et al., 1989).

Even if there are researches carried out for many decades concerning elucidation of the composition and structure of humic substances, this issue it remains still unsolved. The difficulties related to identification of structures of humic substances are generated by their large chemical heterogeneity and geographical variability (Piccolo, 2001).

The understanding of the molecular size and shape of humic substances is intensively discussed and there are opinions according to which humic substances are polymers in the soil and the conformational nature may be regarded as supramolecular associations stabilized by weak dispersive forces (Piccolo, 2001).

Based on solubility in alkali and acids, humic substances may be divided into humic acids, fulvic acids and humins (figure 1, figure 2) (Verlinded et al., 2009); also, are formed by compounds with complex structures and beside lignin, protein and saccharides contain hydroxilic compounds, polycarboxilic aromatic acids, quinones and heterocyclic compounds with nitrogen and oxygen (Madjar et al., 2009).

Humic substances have numerous carboxylic groups and weakly acidic phenolic ones, which are involved in complexation and also in ion exchange properties. Moreover, due to the hydrophobic and hydrophilic characteristics can bind to soil mineral surfaces (Mikkelsen, 2005).

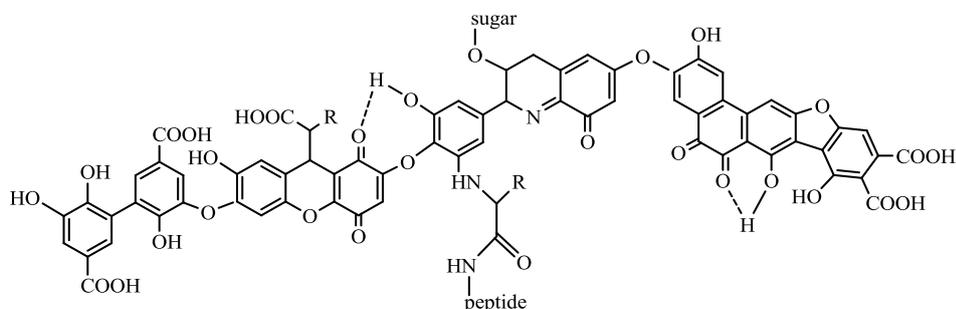


Figure 1. Model structure of humic acid; R can be alkyl, aryl or aralkyl (Stevenson, 1982; Pena-Mendez et al., 2005)

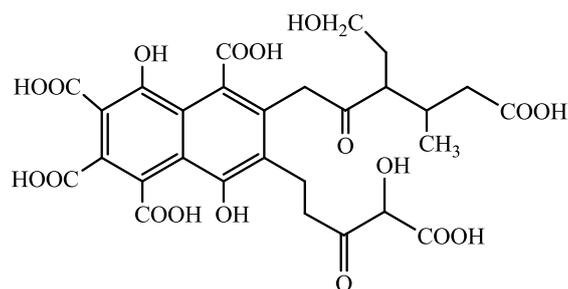


Figure 2. Model structure of fulvic acid (Buffle et al., 1977; Pena-Mendez et al., 2005)

When on exchange sites in the place of hydrogen are present other cations, the resulted product is humate. Humate of alkali metals are water soluble meanwhile, humate of multivalent metals are insoluble (Senn et al.,1973).

The role of humic substances on soil properties

In past decades, the fertility of soils has been declining due to extensive use of land and of chemical fertilizers in quest of producing more food for ever increasing population. The content of organic matter of most soils is below the critical level. Extensive use of chemical fertilizers has been inflicting adverse effect on the environment causing pollution and damaging beneficial soil flora and fauna, causing erosion and lower crop quality (Kumar et al., 2000). Accordingly, humic substances are mostly used to remove or decrease the negative effects of chemical fertilizers from the soil. The role of humic acid is well known in controlling, soil-borne diseases and improving soil health and in availability of mineral nutrients uptake by plants (Mauromicale et al., 2011).

They play an important role from the agronomical point of view, because they influence significantly the quality and productivity of the soil.

The indirect effects of humic compounds on soil fertility include: (i) increase in the soil microbial population including beneficial microorganisms; (ii) improved soil structure; (iii) increase in the cation exchange capacity and the pH buffering capacity of the soil (Saruhan et al., 2011).

In addition to the improvement of the soils physical properties, humic substances also show a high cation exchange capacity (CEC), which is important for soil fertility (Zhang et al., 2004).

It has been proven that humic substances enhance solubility of phosphorus due to complexation of Fe and Al in acidic soil and Ca in calcareous soils (Mikkelsen, 2005) and increase the cation exchange capacity and the pH buffering capacity of the soil (Asal et al., 2015).

In recent years, humic acid has been utilized as a soil conditioner for improving soil physical health and enhancing sequestration of soil carbon. Humic acid manipulates soil physical properties and enhances absorption of nutrients by improving plant resistance against stressed conditions. As humic acid is majorly carbon in its composition, it can be a better source for the improvement of soil physical properties in low carbon soils.

The presence of humic substances promotes good soil structure, increase water holding capacity and assure soil temperature regulation (Billingham, 2012).

Piccolo and co-workers (Piccolo et al., 1996) evidenced that coal-derived humic substances can increase the water retention and available water capacity of soils with low water holding capacity. Moreover, their study confirmed that humic substances can improve the stability of structurally degraded Mediterranean soils when were applied 100-200 kg humic acids/ha.

Other research group observed significant improvement in physical properties like aggregate stability, bulk density, saturated hydraulic conductivity and soil moisture content when 150 kg/ha level of humic acid were applied (Ahmad et al., 2015).

Humic substances favor adsorption of organic compound and pesticides accordingly, control plant pathogens and according to many evidences, present hormone-like activity for plant growth (Billingham, 2012; Trevisan et al., 2010). In certain circumstances, humic acids function as urease inhibitor and nitrification inhibitor (Mikkelsen, 2005).

The biological activity of humic substances, mainly four humic acids and one fulvic acid on seed germination and early growth of *Chenopodium album* agg. was investigated (Sera et al., 2011). The humic substances were extracted from lignine, cambisol, podzol and mountain spruce forest soil. The results indicated that all humic substances stimulated seed development, the greatest stimulation effect being attributed to humic acid extracted from lignite.

Extraction of humic substances

The classical procedure for humic substances (HS) recovery from organic matter consists of an alkaline extraction of humic and fulvic acids, leaving a solid residue formed by

humic and inorganic matter (figure 2). Acidification of the alkaline extract promotes the precipitation of the humic acids, leaving fulvic acids in solution (Benites et al., 2003).

Separation of HS from peat with a grain size below 0.21 mm was found to be optimal by using as extractant a 0.5 N KOH solution, an extraction time of 4 h and a peat to-extractant ratio of 1:20 (mass:volume) at 25 to 30°C under a nitrogen atmosphere with mechanical agitation. It was also found that a larger amount of HS of higher purity was obtained with KOH in comparison with NaOH. The method was effective in separating the HS from peat, but delivered a diluted extract (Saito et al., 2014).

The potassium humate used to obtain the Folhum fertilizer was extracted from coal mass, lignite, with a potassium carbonate solution (Pârvan et al., 2013).

Determination of humic acid concentration is easy but standardization of the methodology used is crucial to obtain useful and comparable results the degree of acidification of the solution to precipitate humic acids will significantly influence the result obtained. The lower the pH used during acidification, the more humic acids will precipitate. Therefore, it is difficult to compare claims from different companies (particularly the USA, China, Russia and Germany where the largest manufacturers of humate products can be found), regarding the humic acid content of these products.

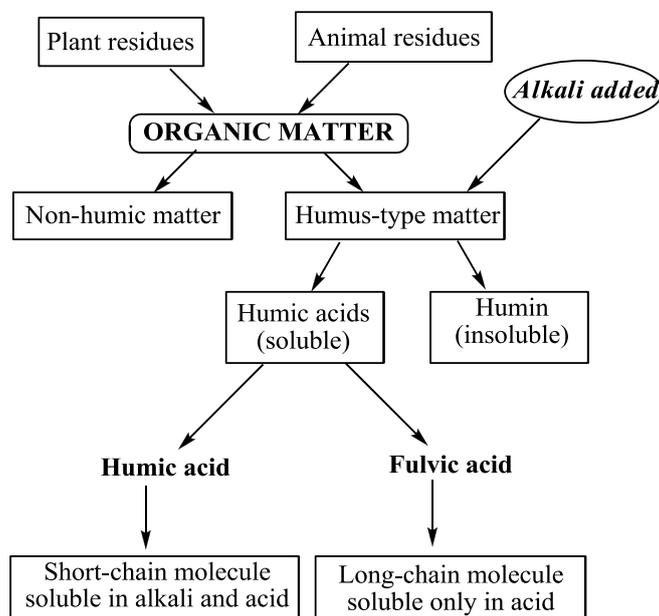


Figure 2. Extraction of various fractions from organic matter (Mikkelsen, 2005)

Fertilizers containing humic substances

Due to their properties, humic substances play an important role in fertilization and many natural products are used to develop new organic fertilizers. Leonardite, a brown coal,

is a material that contain over 90 wt % humic substances is used to obtain organic fertilizers (Saito et al., 2014).

Other material, vermicompost, usually used in horticulture it has been proven to be a great source of humic substances. So far, Hernandez and co-workers (Hernandez et al., 2015) isolated soluble humates from vermicompost and used them for foliar application on lettuce. The results indicated that humate application decreased total carbohydrate content, increased protein content in leaves, increased nitrate uptake and stimulated nitrate reductase and phenylalanine ammonia lyase in leaves.

An organic-mineral fertilizer based on humic substances and potassium was obtained after alkaline extraction of humic substances from peat and it was proved that improved chemical structure of soil and provided a source of organic carbon, readily absorbable by plants (Saito et al., 2014).

Other researchers (Shahein et al., 2014) investigated the effects of humic substances extracted from compost and biogas manure on yield and quality of lettuce. The results indicated that humic substances acted as organic stimulators, enhanced plant growth and yield. Moreover, it was found that nitrate levels in lettuce leaves were the lowest.

Fertilizers based on humic substances are obtained after extraction from organic materials, usually peat or coal that contains at least 10% humic acids. The resulted fertilizers contain sodium or ammonium humates and are used alone or as mixtures with mineral fertilizers (Madjar et al., 2009).

From humic based fertilizers category could be mentioned sodium humate and ammonium humate prepared by boiling peat or coal with a solution of sodium hydroxide and ammonia solution, respectively (Madjar et al., 2009).

Recently, among the fertilization strategies, the foliar spray with different molecules as humic acid has been introduced. These organic substances have no harmful threat to the quality of the environment. Under water stress, foliar fertilization with humic molecules increased leaf water retention and the photosynthetic and antioxidant metabolism.

Foliar spray with humic acid increased root length, and leaf area index, improve plant growth and enhance stress tolerance. In addition, the presence of humic molecules raised the effect on plants of the fertilization based on nitrogen, phosphorus and potassium (Piccolo et al., 1992). In semiarid conditions, foliar application with humic acid may represent an alternative to conventional soil fertilization and a prompt source of nitrogen at grain filling. At grain filling, soil drying induced early senescence, reduced photosynthesis and shortened the

grain-filling period in wheat plants (Yang et al. 2000). The fertilizer named Jinong used in China is an organic liquid fertilizer, whose main constituent is humic acid. Humic acid fertilizer is the essence of farm manure, its effect on increasing crop yield is more significant than chemical fertilizers and manure. Jinong organic liquid fertilizer contains 65.54 g/L humic acid; 20.58 g/L of N; 23.69 g/L of P; 21.67 g/L of K; 2.03 g/L of Cu + Fe + Zn + Mo + Mn + B; 2.8% of water and pH is 4.3 (Kowsar et al., 2015).

An experiment developed with the aim to analyze the influence of Jinong on seedling germination and growth of bread wheat in comparison with biofertilizer *Azotobacter* sps. and farmyard manure revealed that organic fertilizer humic-containing, Jinong, was more effective than biofertilizer and manure in enhancement of grain number on main shoot, grain number/plant, grain weight/plant, straw weight (Jan et al., 2015).

Eyheraguibel and co-workers (Eyheraguibel et al., 2008), developed a physico-chemical process to transform and enhance lignocellulosic waste in liquid humic extracts: humic-like substances (HLS). The effects of HLS were evaluated on maize seed germination, and their impact on growth, development and mineral nutrition was studied on maize plants cultivated under hydroponic conditions. The experimental results showed that HLS enhance the root elongation of seeds thus treated. Positive effects were also observed on the whole plant growth as well as on root, shoot and leaf biomass. Furthermore, the use of HLS induced a flowering precocity and modified root development suggesting a possible interaction of HLS with developmental processes. Considering the beneficial effect of HLS on different stages of plant growth, their use may present various scientific and economic advantages.

Folhum, a liquid fertilizer with humic substances as potassium humate was tested on tomato and sunflower culture in vegetation house and the experiment reveals increases of the yield by 45.5% in the Dacia Pontica tomato and 49.2% in the Justin sunflower (Pârvan et al., 2013).

Another research group (Verlinden et al., 2009) studied the effect of humic substances on yield and nutrient uptake of grass, maize, potato and spinach. The humic substances originating from leonardite formations in Canada were applied as liquid solution to the soil (Humifirst liquid) or as a solid incorporated in mineral fertilizers (Humifirst incorporated). Application of humic substances at the start of the growing season induced an overall positive effect on dry matter yield in the field and pot experiments. The observed effects were largest for the potato field (total potato yield increased with 13 and 17% for Humifirst liquid and Humifirst incorporated, respectively), followed by the grasslands and were smallest for the

maize fields. Plant uptake of nitrogen, phosphorus, potassium, and magnesium was improved as well, while sodium and calcium uptake was not affected. Especially, the increased uptake of nitrogen and phosphorus by plants and thus a more efficient use of fertilizers are very important in terms of nutrient legislation in high input cropping systems.

CONCLUSIONS

Humic substances improve global soil fertility levels and accordingly plant growth, and play an important role in controlling the mobility of pollutant species in the environment. Lately, the humic substances are recognized as possible manner to face environmental problems due to their ability to remove toxic metals, pesticides and other organic pollutants. Other application of humic substances in to generate new fertilizers having in view their potential to enhance absorption of nutrients by improving plant resistance against stressed conditions. The unique properties of products that contain humic substances enable their efficient application in agriculture and for environmental purposes.

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PIECES OF THE SIBIU TRADITIONS THE VILLAGE OF GURA RÂULUI

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Abstract

The residents of the Gura Râului communities in the mountains gathered their feelings, mythical and religious experiences and, especially, that unique sense of making things right. The rural infrastructure development is influenced by the landscape or architecture of the houses, the type of the street ground, the historic pastoral occupation, the transhumance. A Gura Raului villager will never say “Look, there is a forest of trees, beech or maple”. He will say “Look, there are trunks, beams or planks” because they value the utility of things more than the things themselves.

Keywords: village, tradition, transhumance, heritage, development

INTRODUCTION

If we were to walk along the 900 km Romanian Carpathian path, from the Upper County of Oaș to the Iron Gate of the Danube, every evening, we could find shelter to people who live their lives in their homes and villages, who work roughly and whose habits are old and green in time like the rocks where they have built their settlements.

Assuming the values of tradition of these communities means judging the world from a different perspective than the scientific and rationalist one, which, nowadays, marks the contemporary thinking. The residents of these small communities in the mountains gathered their feelings, mythical and religious experiences and, especially, that unique sense of making things right throughout the lands of Lăpuș, Apuseni or Caraș forming those extensive areas of experience that our ancestors called “Countries” such as: the Country of Dorna, Loviștei and Moșilor. Even in the geographical center of Romania, there are two such countries: the Country of Olt, at the bottom of the Făgăraș Mountains and the Outskirts of Sibiu (Mărginimea Sibiului) from the Cindrel to the Lotru Mountains.



The communities of Sibiu County, you can find from the fascinating Transfăgărășan in southeast and the Transalpina in northwest, express through their traditions fundamental elements of spirituality, open to the horizon of knowledge and significance of our own folklore culture. These cultural expressions

reverberate, even today, even if they are too much analyzed through the European spirit, thus, challenging the reader to detach himself for a pray:

*"I might forget everything I know/
A great cold to desert my soul/
But let me stay the way to Sibiu /
And to its Heaven Outskirts",*
- as a great poet of the transit generation wrote.

MATERIAL AND METHODS

With this living spirit in soul, there are 18 settlements spread throughout 1200 km². Settled at the bottom of the southern Carpathian slope, the people here created the „concept – village” as one of our great philosophers spoke about.

And, as for more than a decade (1950-1961) Lucian Blaga spent yearly vacations,



summers and winters in such a village, naturally, we wondered why there? or what is there? I found the answer in a letter that the poet recommended to a friend of his: "... you should visit once the village of Gura Râului in order to understand what that corner of Paradise with ancient Romanian culture means".

We found there the village of Gura Râului - Bocca del Rio, how the poet nicely presented the village and how it is referred to by the priest Joachim Muntean in his first monography of the village, printed on the 25th of March 1896 [2]. He said: "the village is shaped like a horn tip between the hills and directed to the West, but with the opening turned towards the North, all its sides being surrounded by hills".

As there are many richly built houses, I stayed in one, modest, old and bent of times, once belonging to the Manta family. A century and a half, from father to son, the family Manta`s men were priests of that village. In the backyard of their house, settled on the bank of the Cibin river, there found shelter many of the Romanian writers such as Eminescu, Goga, Vlahuță, Agârbiceanu, St. O. Joseph Chendi or Coșbuc. The latter reminded of the priest Manta in one of his poems in a comic way: *“Oh, poor priest Manta, / How much you liked the wine in big cups”*.

Here, in the village of Gura Râului, the “Prea Cuvioasa Parachiva” Church was built later (its tower, only in 1788) on the site of the former one, built in 1202. The heritage of Gura Râului villagers, like the one of the Outskirts of Sibiu, is hard to evaluate, but it is certified by the ancients settlements such as: the village of Gura Râului built in 1383, the village of Orlat built in 1322, the village of Sălișteu built in 1354, not to mention the village of Sadu, that, later, was the first village electrified in Romania. The village of Sadu was the birth place of Ioan Inocențiu Micu Klein, Samuel Micu, Popa Tunsu - Ioan Piuaru`s son. More than this, this was the birth place of Onisifor Ghibu, Ioan Lupaș, D. D. Roșca, Ionel Paul Dorin, Axente



Banciu, all members of the Romanian Academy. It would be a pity not to mention the village of Rășinari, where Goga and Cioran were born, the unforgettable childhood in "Coast to Boacii" by Aaron Florian from the village of Tilișca who contributed to the founding of the Romanian Academy, or Ioana Postelnicu from the village of Poiana Sibiului

or Naum Râmniceanu from the village of Jina. The latter wrote both the “Chronicle of Blaj” published in 1800 and the “History of Zaver” published in 1828. Many other major figures of our nation left from the Outskirts of Sibiu and crossed the Carpathians mountains through the border called the “Vama Cucului” (the “Cuckoo’s Custom”). At the moment they left home, they had an important cultural education that they were to share to the whole nation by their acts and writings.

For sure, they were educated in the same school in the village of Gura Râului whose modest plaque says: “Culture is Power”.

Maybe this culture begins to manifest itself 5-6 years before going to school. When you come here, everybody says “Hello”, from the oldest to the youngest.

Nobody in these 18 villages of the Outskirts of Sibiu will give his traditional costume to foreigners in exchange for jeans - as it was said by the anthropologist Vasile Avram in the “Cosmic Christianity”. That could happen only in a rootless village. “They are born to wear jeans (a sign of victorious pragmatism), the foreigner is meant to wear jeans and they are proud of them (a sign of grudging nostalgia after a lost tradition).” Precisely for this reason, we consider the theme proposed by the Mountain Forum in Romania at this event, is important and current. Because, as Petre Țuțea wrote in the “Manifest of the National Revolution”, both then and now, *“our state defends foreigners from us: they build a railway line or a road not for us and where we need them, but for them and where they need”*.

RESULTS AND DISCUSSIONS

Nowadays, things happen similarly. Only our folklore culture is rich in mythical-religious imaginary, the development of ritual beliefs about the universe, the origin of world, of man and plants. Mircea Eliade exemplified the religious creativity of folklore type



throughout the Romania, through the “cosmic wedding” in Miorița or through the script of the Christmas carols, of the “Călușari Dance”, events that have survived because of the richness of beliefs that have been continuously transmitted and learned over and by generations. In the village of Gura Râului, you can admire folklore dances

such as: the “Învârtita”, the “Purtata”, the “Hațegana” and the “Jiana”. These are danced every

Sunday in the "Pavilion" Hall, in the village square. But, surely, you have admired the folklore dance group, the "Cindrelul Junii Sibiului" born here, in the village of Gura Raului, in 1944 [1].

After the Sunday Church Service, the priest and the Mayor read "The Ten Commandments" in front of the church. The Mayor presents to the villagers what he achieved along the past week and announces what is going to be done for the community in the following week. Here, the "commands" come from the local people who elected the best householders to lead their community. The Mayor and his staff only achieve those "commands".

In all the settlements in the Outskirts of Sibiu, the rural infrastructure development is influenced by the landscape or architecture of the houses, the type of the street ground, the historic pastoral occupation, the transhumance which begins every autumn and finishes next year on the St. Constantine's day. The duration of the transhumance is also presented in an old song. Every family has a second household in the mountains, where their parents and grandparents had the land before [3]. These households contain in proper houses, barns, shelters for animals and vegetable gardens. In the summer time, the whole family moves to places called Tomnatic, Vârtoape, Pogoana. For example, from the center of the village of Jina up to its border, in straight line, it is about 80 km. There are forested mountains with alpine meadows and pastures of silk grass, valleys, rivers and mountain clear lakes. There, the forests touch the sky. A Gura Râului villager will never say "Look, there is a forest of trees, beech or maple". He will say "Look, there are trunks, beams or planks" because they value the utility of things more than the things themselves.

CONCLUSION

Of course, I could not comprise the multitude of the exceptional values existing in this geographic area inhabited by more than 33,000 people, 98.13% of them having Romanian ancestry. If I were to mention the 2,000 ha estates belonging to the small villages or the 15,000 ha ones belonging to the larger villages of Jina or Rășinari, that are the alpine pastures where shepherds climb their flocks from May to September, it would take a lifetime [4]. Because, at 1,000 m altitude, in sheepfolds where boils a big pot hanging over the fire hook, there has been coming into being another world... for centuries. The schoolchildren from the Outskirts of Sibiu finish the courses on the 15th of May in order not to miss the so-called "the life school in the mountains", which is worth attending.

To conclude, with respectful bows, we are looking forward to meeting you at our house to spend the night at a forest edge, at a fire which burns out slowly towards dawn, as it is said in the following poem: *“Let us hear the sheep bells/ Let us hear the dogs bark and see the peaceful shepherds/ No one draws us back into the world”*.

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QUANTIFICATION OF ANTIMYCOTOXIGENIC EFFECT OF ESSENTIAL OILS ON CONTAMINATED STORED GRAINS

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Abstract

Mycotoxins are secondary metabolic products of some fungal pathogenic species, mainly Aspergillus, Penicillium and Fusarium, contaminating growing culture plants in agricultural field and further transferred from field to storage spaces at the harvest time. Cereals, spices, nuts and dried fruits are the most exposed to contamination, infecting feed and food products made with eggs, milk, and meat, seriously affecting the health of animal and human final consumers. Mycotoxins are chemically stable compounds, very toxic at low doses and difficult to remove from all the sequences of the food chain. Aflatoxins (AFT) demonstrated carcinogenic, teratogenic, mutagenic and immunosuppressive activity for mammals. Fumonisin (FUM), ochratoxin (OTA) and zearalenone (ZON) were also dangerous mycotoxins detected in stored grains and should be limited by ecofriendly treatments. Antifungal activity of some essential oils or their formulated (bio)products for stored grains protection could be demonstrated by simultaneous determination of mycotoxin concentration, in contaminated and treated cereal samples. Present paper describes the development and optimization of one-step analytical method of liquid chromatography coupled with mass spectrometry based on the "time of flying", using the system 6224 TOF LC/MS (Agilent Technologies, USA), a modern and exact tool for monitoring multiple mycotoxins from grain single matrix.

Key words: mycotoxin, stored grains, essential oil, analytical method

INTRODUCTION

Mycotoxins are natural food and feed contaminants, mainly produced by fungal strains such as *Aspergillus*, *Penicillium* and *Fusarium*. Toxic effects of aflatoxins include carcinogenic, mutagenic, teratogenic, and immunosuppressive activity. Aflatoxin B1 (AFT B1) is the most potent hepatocarcinogen known in mammals and it is classified by the International Agency of Research on Cancer (IARC) as Group 1 carcinogen (IARC, 1993) [1]. Due to the fact that infants are at much higher risks of health problems compared to adults, the maximum legal limit allowed for AFB1 in infant food in the European Union is 0.1 µg kg⁻¹ [2]. Peanuts, cereals, spices, coffee, cocoa and dried fruits are often contaminated with mycotoxins. Mycotoxins are chemically stable, very toxic at low concentration and difficult to remove.

Cereal grains and associated by-products constitute important sources of energy and protein for animals. When cereals grains and animal feed are colonised by fungi, a significant risk of contamination with their toxic secondary metabolites is imminent. Specific toxicity syndromes such as equine leukoencephalomalacia and porcine pulmonary oedema have been

linked with fumonisins contamination of feed. There are recent association of FUM B1 with carcinogenesis in human beings, because concerns over the possibility that *Fusarium* mycotoxins may be transferred into milk, eggs and meat had considerably increased. Several surveys underline that *Fusarium* mycotoxins may co-exist with each other and with aflatoxin B1, an *Aspergillus* compound, sharing carcinogenic properties with fumonisins. Advances techniques such HPLC and GC with mass spectrometry are now the methods of choice and justify the actual needs for compilation the data.

MATERIALS AND METHOD

Micotoxins reference standard: Aflatoxins (B1, B2, G1, G2), Ochratoxin A, Fumonisin (B1, B2) were obtained from Trilogy Analytic Laboratory, Washington, USA. Corn powder (100 mg) Naturally Contaminated with Mycotoxins - multitoxin reference material TR-MT100, batch number MT-C-9999G (exp.date: 2020) was purchased from Trilogy Co. Ltd., Washington, USA. All immunoaffinity columns were obtained from R. Biopharm Rhône Ltd., Scotland. All the chemicals were of analytical grade and all the aqueous solutions were prepared with distilled water. Methanol HPLC grade, acetonitrile HPLC grade and ammonium formate were obtained from Sigma-Aldrich, Germany.

Standard solutions

Reference standard solutions were used after reconstitution and dilution with the suitable solvent or solvents mixture, according provider's recommendations. These solutions were used for confirmation and quantification of the micotoxins in the tested samples.

Sample preparation

Sample processing consists of several steps: extraction, filtration/centrifugation and dilution. Extraction step consists of blending for 2 min. 25 g ground sample (corn powder reference material or cereals grains) + 5 g NaCl + 100 mL 70% methanol. Filtration step consists of filter or centrifuging the extract at 4000 rpm for 10 min. Dilution step consists of diluting 5 mL of supernatant with 60 mL of phosphate buffer saline (PBS) solution.

Extraction solvent used for mycotoxins reference material:

- water/ACN (16:84) (v/v) for AFT, Deoxynivalenol (DON), ZON
- water/ACN (40:60) (v/v) for OTA
- water/MeOH (30:70) (v/v) for FUM

Sample clean-up

Separation or sample clean-up is based on a solid phase extraction (SPE) using immunoaffinity columns with high technical performances. The stationary phase consists of an antibody (or antibody-related reagent) with high selectivity for a target compound. The columns are specific for AFT, DON, ZON, OTA or FUM.

In this study were used two types of immunoaffinity columns from the company R-Biopharm Rhône Ltd. (Scotia, UK): AOF MS-PREP column for separation of AFT, OTA and FUM; DZT MS-PREP column for separation of DON and ZON.

This simple and safe method for laboratory, can be used with HPLC-FLD, UHPLC-LC/MS for detection and separation of single or multiple mycotoxins in matrices. The main operations consisting in:

- Pass 20 mL of diluted extract through the column at a constant flow of 2 mL/min, for capture the toxins by antibody.
- Wash the column with 20 mL water at a flow rate of aprox. 5 mL/min.
- Elute the mycotoxins with 1 mL 100 % methanol at a flow rate of 1 drop/sec. and collect in a glass vial.
- Pass 1 mL water and collect in the same vial.



Fig.1. SPE kits based on immunoaffinity columns for separation of mycotoxins.

Isolation and purification entire operation lasts about 20 minutes. Chromatography column procedure provides a clean and pre-concentration of the compound of interest by removing the interference from the sample matrix to be analyzed, improvement of sensitivity and high accuracy (Fig. 1). The eluted fractions are collected and analyzed in parallel by LC / MS and HPLC-FLD.

Analytical methods

Two methods were used for the determination of mycotoxins in grains: liquid chromatography with fluorescence detector (HPLC-FLD) and liquid chromatography coupled with mass spectrometry based on “time of flight” (TOF ESI-LC/MS).

HPLC-FLD was performed in the following conditions:

- Column: Hypersil Gold C18, 5 µm, 100 x 4.6mm (Thermo Scientific)
- Mobile phase: water/ACN (80:20) (v/v)
- Flow: 1.0 mL/min
- Column temperature: 40°C
- FLD setting: 360 nm excitation, 460 nm emission

TOF LC/MS set-up was performed in the following

a) LC conditions:

- Column: Hypersil Gold C18, 5 µm, 100 x 4.6mm (Thermo Scientific)
- Gradient elution (Table no.1) of mobile phase:
 - *mobile phase A*: 0.1% formic acid in 5 % methanol and 1 mM ammonium formate
 - *mobile phase B*: 0.1% formic acid in 98 % methanol and 1 mM ammonium formate

Table 1

Gradient elution for separation of micotoxins mixture

Time (min.)	A%	B%	Flow (mL/min.)
0	80	20	0.5
10	10	90	0.5
15	10	90	0.5
15.1	80	20	0.5
35	80	20	0.5



b) MS conditions:

- Temperature ESI source: 350 °C
- Capillary voltage: 3500 V
- Fragmentator voltage: 100 V
- Nebulizer pressure: 40 psig

Injection volume: 20 µl

RESULTS AND DISCUSSION

Because of differences in the structure, all mycotoxins cannot be determined in the same array by a single HPLC/FLD method [4, 5], specific procedures needed for each case. The method of liquid chromatography based on the fluorescence detector, can be applied to

determine only certain mycotoxins, each using derivatizing agents pre- or post chromatographic separation, and various chromatographic conditions (mobile phase, column). Separation of aflatoxins standard in the chromatographic conditions for HPLC/FLD described in the previous section, is shown in fig. 2.

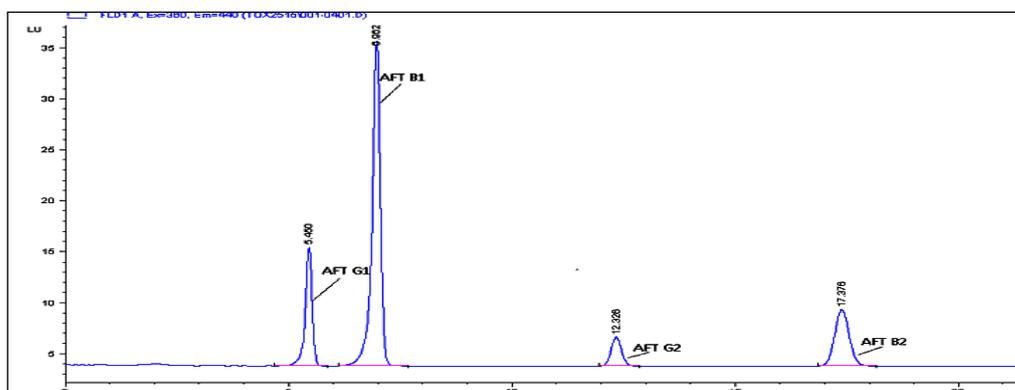


Fig. 2. Separation of AFT B1, B2, G1, G2 after derivatization with a mixture of (water : TFA: acetic acid) (70:20 :10) (v/v/v), at 60°C for 20 minutes.

In this study the molecular masses of mycotoxins were evaluated by high accurate detection techniques such as mass spectrometry with time of flight, separated under specified chromatographic conditions. The LC/MS method is sensitive, rapid and accurate, and makes simultaneous separation and identification of mycotoxins [6]. The typical chromatogram for standard micotoxins is presented in fig. 3.

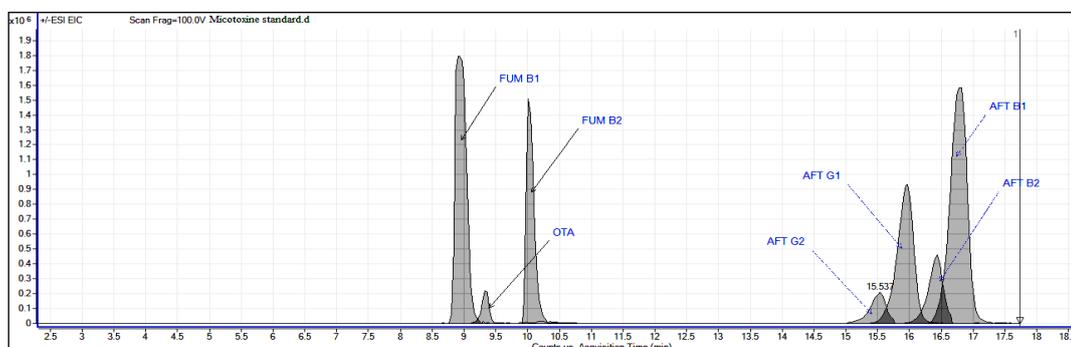


Fig. 3. Extracted ions chromatogram (EIC) for standard solutions.

High mass accuracy (less 5 ppm) identification of the mycotoxins is shown in the table no. 2.

Table 2

Extracted masses of the main standard toxins separated by TOF LC/MS

Mycotoxin	Precursor n	m/z charge
AFT B1	[M+H ⁺]	313.3811
AFT B2	[M+H ⁺]	315.4147
AFT G1	[M+H ⁺]	329.5447
AFT G2	[M+H ⁺]	331.5806
OTA	[M+H ⁺]	403.9874

FUM B1	[M+H ⁺]	723.0496
FUM B2	[M+H ⁺]	705.9129

The results obtained for the multi-toxins reference material sample, according methodology and extraction procedures used in our laboratory, are presented in table no. 3.

Table 3
Extracted masses of the main standard toxins separated by TOF LC/MS

Compound	SI units
AFT	13.8 ppb
DON	1.8 ppm
FUM	6.0 ppm
OTA	62.1 ppb
ZON	226.3 ppb

The effectiveness of essential oils was quantified by analyzing treated samples before and after 5 months in contact with a formulated product. One example of the results obtained after *in situ* application of Thyme oil based micro-granules is presented in figure no 4.

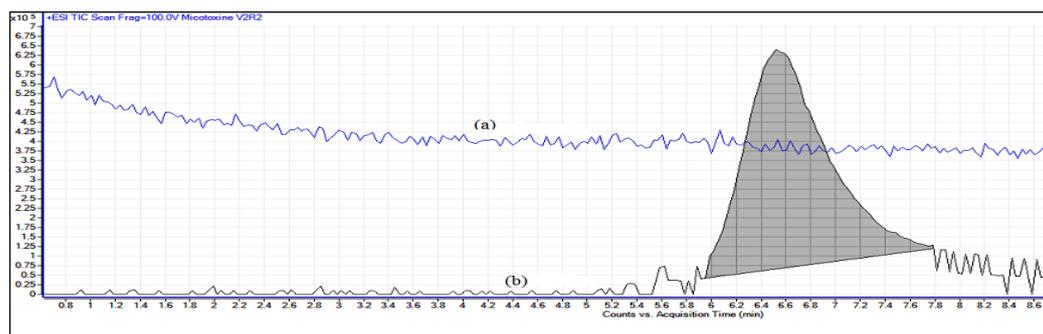


Fig. 4. Comparative chromatograms of a grain sample: a) after treatment; b) initial (contaminated with ochratoxin A).

CONCLUSIONS

The results obtained in our research represent the first step of applying modern techniques for the separation, identification and quantification of mycotoxins in stored grains. The study for testing effectiveness of organic bioactive products to prevent contamination in the food chain, warehouses or distribution of food, sets the stage for further research that contributes to solving problems related to quality of life in general.

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CHEMICAL MODIFICATION OF STARCH FOR NEW MATRIX USED IN ENVIRONMENTAL DEPOLLUTION

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Abstract

*The aim of research is to achieve chemical modifications of an important agro-resource like starch. It is an exploitable biopolymer produced by vegetables, such as corn (*Zea mays* Poaceae) and potato (*Solanum tuberosum* Solanaceae). For the development of renewable bioproducts with new properties, such the solubilization of organic persistent pollutant, i.e. benzo[a]pyrene, modified starches were synthesized by alkylation. The addition of alkyl chains (propylene oxide or succinic anhydride) was performed. The properties of new starches were characterized: ¹H NMR spectrum, aqueous solubility, BaP solubilization and maximal BaP solubilization. In comparison with the native starches, the new products showed an enhancement of their aqueous solubility, a stimulated property of the BaP aqueous solubilization and an increment of surfactant property. These products could be used in further researches for enhancing pollutant bioavailability for microorganisms as agents of soil bioremediation.*

INTRODUCTION

Starch is a natural, renewable and biodegradable polymer produced by plants as a source of stored energy. Starch is composed of unbranched and slightly branched amylose molecules (BeMiller, 1997) and highly branched amylopectin (Manners, 1989). Chemical modifications of starch with functional reagents, such as alkyl oxides or succinic anhydride, have been used to introduce new properties of starch and extending its applications for instance in food, paper, textile and environmental fields (Crini, 2005; Rosu et al., 2013; Delsarte et al., 2016).

In order to explore the potential of starch from different sources, we chose to modify by esterification or etherification reactions the starch molecule from corn (*Zea mays* Poaceae) and potato (*Solanum tuberosum* Solanaceae). The corn contained only amylopectin (100%) and no amylose in the starch molecule (BeMiller, 1997). Chemical composition of starch from *Solanum tuberosum* is represented by two compounds: amylose (30-40%) and amylopectin (60-70%), a highly branched molecule.

The aims of our researches were to synthesize potato and corn starch derivatives by alkylation reaction using ether (propylene oxide) or ester (succinic anhydride) alkyl agents in order to fulfil two main objectives: firstly to increase the aqueous solubility of modified starch

and secondly to allow benzo[a]pyrene (BaP) solubilization permitting therefore its retention in polysaccharide based materials. Indeed, BaP, a high molecular weight polycyclic aromatic hydrocarbon, is a toxic, carcinogenic and mutagenic compound (White, 1986) which tends to persist in the environment because of its very low water solubility and its tendency to be strongly absorbed on soil organic matter (Cerniglia, 1992; Wilson et al., 1993).

Such chemical modifications of starches have been used to introduce new properties permitting their use as potential surfactant agent for enhancing BaP bioavailability for microorganisms, such as fungi (Veignie et al., 2009). These researches extend starches applications as renewable for soil rehabilitation.

MATERIALS AND METHODS

1.1. Chemical modification with alkyl agents

The chemical modification of starch was realized by varying several parameters: the botanical origin of the starch (corn or potato), the solvents used (dimethyl sulfoxide - DMSO or water), the temperature (21°C, 50°C and 95°C) and the duration of the reaction (6, 38 or 78 hours). Potato starch modified by etherification (PO) was obtained by the following protocol: DMSO as solvent, 0.66% NaOH as catalyser, 32% ether agent (propylene oxide) at 21°C for 78 hours (Rosu et al. 2011). Potato starch modified by esterification (PA) was conducted at 21°C for 6 hours in presence of DMSO and 10 % NaOH, with a 3:1 molar ratio of ester and alcohol function in anhydroglucose unit (AGU) of starch (Rosu et al. 2013). Chemical modification of corn starch with ether (propylene oxide) (CO) was realised at 95°C for 38 hours in a solvent mixture of water:DMSO in 1:4 ratio, 10 % NaOH. The same conditions were respected for chemical modification of corn starch with esterification agent i.e. succinic anhydride (CA) (Rosu et al., 2017).

On completion of reaction, the modified starch was neutralized with hydrochloric acid and, after solvent evaporation, dialyzed during 4 days using a cellulose membrane (Medicell International, MWCO of 12–14,000 Da) and lyophilized.

In the table 1 are presented the new starches compounds from both botanical sources.

Table 1

The new starches compounds obtained by chemical modification

Botanical source	Alkylation agent	Acronym
Potato (<i>Solanum tuberosum</i>)	-	P
	Propylene Oxide	PO
	Succinic Anhydride	PA
Corn (<i>Zea mays</i>)	-	C
	Propylene Oxide	CO
	Succinic Anhydride	CA

1.2. Structural characteristics of starch derivative

1.2.1. ¹H NMR spectroscopy

Each starch derivative was characterised by a ¹H NMR spectrum in order to prove the chemical modification of the starch. ¹H NMR spectra were measured with a 250 MHz Spectrospin NMR spectrometer (Bruker, France) in deuterated DMSO, ambient temperature, relaxation delay 1s, pulse angle 30°C, acquisition time 6 s and with a total of 50 scans.

1.2.2. Determination of the aqueous solubility

We determined the aqueous solubility of each modified starch by preparing a saturated solution of the product at room temperature. After 24 hours, 10 mL of the solubilized starch were lyophilized and weighed in order to obtain the quantity of soluble modified starch. The solubility was evaluated in three replicates for each modified starch.

1.3. BaP solubilization in the presence of modified starch

BaP was dissolved in dichloromethane (DCM) and then deposited into a haemolysis tube by the addition of 375 µL of BaP solution. The solvent was evaporated and 3 ml of water (as reference) or the tested starch was added in a haemolysis tube. The tested concentration was 5 mM equivalent AGU of starch. The tubes were incubated in the dark for 4 days. BaP fluorescence in carbohydrate polymer solutions was analysed on a Perkin Elmer LS B50 spectrofluorimeter (excitation 295 nm, emission 406 nm, time integration 10 s according to Veignie et al., 2009). Results are expressed as BaP concentration in the aqueous phase.

1.4. Specific activity of modified starch and maximum BaP solubilization

For each new modified starch, a specific activity (SA) for BaP solubilization was calculated. It represented the amount of solubilized BaP (µg) per gram of modified starch. It allowed us to calculate, for each modified starch, the maximum BaP solubilization by the equation: Maximum BaP solubilization = specific activity X aqueous solubility (Delsarte et al., 2016).

RESULTS AND DISCUSSION

1.5. Characterization of modified starch

All the chemical starch derivatives were tested by ^1H NMR spectrum to prove the chemical modification with alkyl agents. The **figure 1** presented the ^1H NMR spectrum in deuterated DMSO of starch derivatives. The NMR spectrum was characterized by a very broad and complex multiple proton resonance signals between 3.35 and 4.20 ppm due to protons of starch AGU. The proton signal around 5.20-5.45 ppm was attributed to the anomeric equatorial proton of the starch AGU (De Graaf et al., 1995). The ^1H NMR spectrum of the hydroxypropylated starches (PO and CO) showed the apparition of the singular proton resonance signal at 1.15-1.25 ppm indicating the grafting of the alkyl chain on starch structure (Rosu et al., 2011, Teramoto et al., 2002). The esterification of starches by succinic anhydride (PA and CA) was successful as indicated in the present NMR spectrum by the apparition of peaks around values 0.90-1.40ppm (Chi et al, 2007, Marcazzana et al., 1999, Rosu et al., 2013, Rosu et al., 2017).

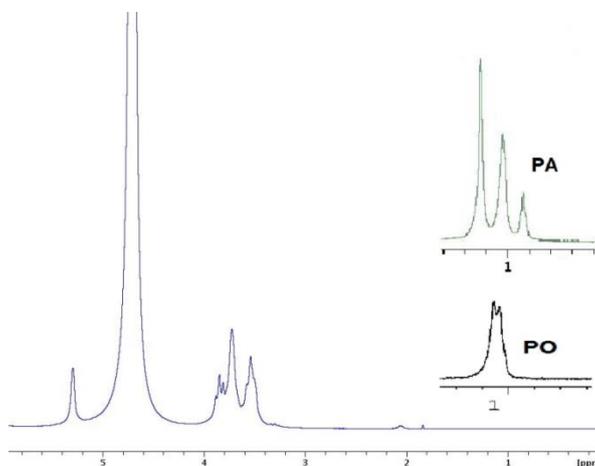


Figure 1. ^1H NMR spectra of starch derivatives

(PO - potato starch modified by etherification with propylene oxide; PA – potato starch modified by esterification with succinic anhydride)

1.6. Aqueous solubility of new starches and BaP solubilization in the presence of each modified starch

The chemical characterization of starch derivatives was supplemented by the determination of aqueous solubility of the new products. This characterization influenced the

BaP solubility in starch derivatives solutions. The **figure 2** presents the relationship between the aqueous solubility (g/L) of the modified starch and the BaP solubilization for each new starch product obtained ($\mu\text{g/L}$).

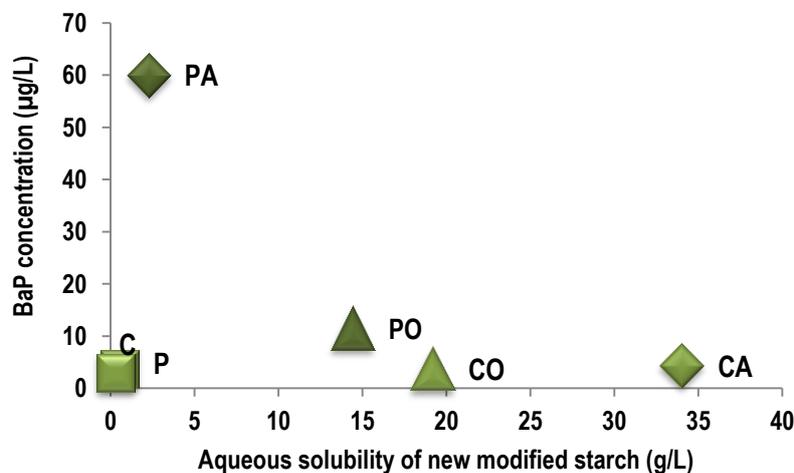


Figure 2. Relationship between the aqueous solubility of starch product (g/L) and the BaP solubilization for each new starch ($\mu\text{g/L}$)

The native potato starch (P) and corn starch (C) were characterized by a low water solubility and also a low ability to solubilize BaP.

PO and CO displayed a higher affinity for polar solvent such as water as their own aqueous solubility was respectively 14.41 g/L and 19.16 g/L. These values were largely superior to the native starch ones (P and C), respectively 0.5 g/L and 0.3 g/L. As the length of the alkyl chains grafted was quite short (<10 atoms of carbon), this result indicated that the addition of short chains did not stimulate the hydrophobic character of the modified product but rather its hydrophilic properties (Rosu et al., 2011). PA obtained by esterification presented the highest capacity to solubilize BaP (>60 $\mu\text{g/L}$) despite a quite low water solubility.

When corn starch was used as botanical source, due to the amylopectin composition of the molecule, the esterification with succinic anhydride enhanced the hydrophilic character and consequently the aqueous solubility of the new obtained starch (CA: 34 g/L) (Rosu et al., 2017). Concerning BaP solubilization, CA had a low ability to solubilize the pollutant, due to the addition of short of alkyl chains. All these results were confirmed by the specific activity of each new starch and by the maximum BaP solubilization.

3.3. Maximum BaP solubilization of modified starch

The results concerning the maximal theoretical value of BaP solubilization for each new product were presented in the **figure 3**.

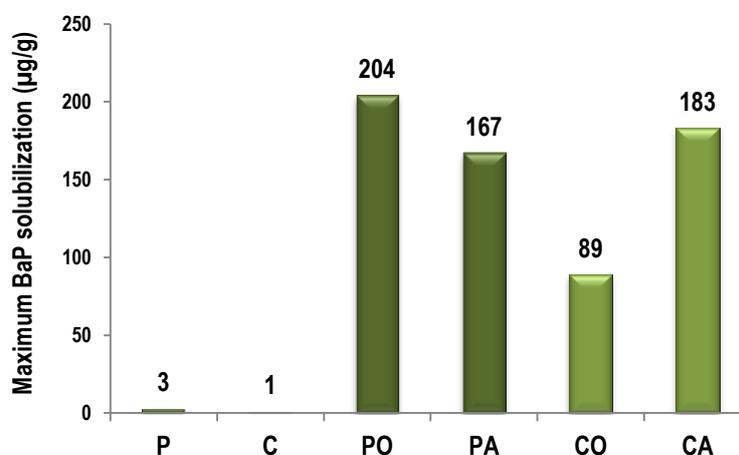


Figure 3. **Maximum BaP solubilization (µg/g) of modified starch**

According to these calculations, new starches from potato source have a significant influence for the maximal BaP solubilization (respectively 204 µg/L for PO and 167 µg/L for PA) compared to the BaP aqueous solubility (3 µg/L). Comparing the alkyl agent (propylene oxide or succinic anhydride), there is no significant influence on the maximal BaP solubilization. However, the new starches from corn source showed a different result. There was a twofold increase for maximal solubilization (183 µg/L for CA) in comparison with CO (89 µg/L). This result can be explained with the previous theoretical study of molecular modelisation of starch, in which amylopectin showed numerous sites available for complexing BaP (Rosu et al., 2011). For this reason, it seems that succinic anhydride alkylation could act on starch corn as a factor favouring the retention of the pollutant.

Modifications of starch with alkyl chains result in starch products with amphiphilic side-chains. Jeon, Viswanathan and Gross (1999) reported that the alkenyl succinate are a family of highly versatile derivatives, as they obtained either modified starches with high hydrophilicity or high hydrophobicity, depending on the length of the alkenyl group and the degree of substitution. Other researches obtained also starch effective as an emulsifier due to the addition of hydrophobic side chains to the originally merely hydrophilic starch molecule.

CONCLUSIONS

Chemical modification of starch from two botanical sources (*Zea mays* and *Solanum tuberosum*), by hydropropoxylation or esterification with succinic anhydride lends to

functional properties that could be very promising for future researches strategies. The corn starch modified with alkyl succinic anhydride presented the highest capacity to solubilize BaP. These new matrixes could be further used as surfactants in order to enhance pollutant bioavailability to microorganisms, which is a prerequisite for bioremediation treatment. Moreover, the biodegradability of the biopolymer obtained could reinforce the interest of developing such an innovative and environmentally friendly technology for soil depollution.

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GENETICALLY MODIFIED CROPS AND AGRICULTURE minireview

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Abstract

Genetically modified organisms continue to be a subject of controversy all over the world after more than 33 years of placing on the market of FLAVR SAVR tomatoes. They continue to expand their cultivation all over the world, over 28 countries are opened for this technology and still the rest of the world is not accepting the cultivation of these crops. However, products derived from GMOs are on the general market and accepted all over the world, supporting the cultivation on more than 2 billion ha of genetically modified crops for 2015. The continued marketing of GMOs as plants or products thereof all over the world is a prove that implicitly GMOs are accepted by all governments. The scope of this article is to emphasises the role of GMO in agriculture and economy.

Key words: genetically modified crops, Romania,

INTRODUCTION

Organisms (plants, animals or micro-organisms) in whose genome are transferred genes from other organisms that do not belong to the same taxon are called genetically modified organisms (GMOs). Gene transfer is done either to improve some quality features in certain varieties or races (i.e. resistance to chemical, physical or biological factors) or improve quantitative features (i.e. increased productivity of seeds in plants) in a highly demanding society. The safety issues related to GMOs are known as biosafety (Ammann, K. (2014).

Genetic engineering is currently among the most exciting scientific fields, of high relevance that theoretically through nationwide, regional and global development programs can help eradicate the deadliest diseases, an unprecedented development of the pharmaceutical industry and not last to feed the over 8 billion people of the planet Earth. Genetic engineering is fuelling today the development of nanotechnology, genomics, metabolomics and proteomics. It cannot be discussed today about any of the top scientific field that use genetics without realizing the benefits of genetic engineering in emerging and supporting new filed of science (Vats, 2015).

Practical grounds of genetic engineering reside in supporting for food an increased human population, fighting against pollution and further supporting life on Earth. The population of the globe is constantly growing, so it is necessary to find the fastest techniques

to help increase agricultural output and improve the quality of products to ensure food for all people (Clarke & Zhang, 2013).

To achieve all these goals, agriculture based on modern techniques is needed in terms of both: biological material and agro-technical techniques as well as applied machine systems.

MAIN OBJECTIVES OF GENETIC TRANSFORMATION IN PLANTS

Following the FLAVR SAVR tomatoes (Kramer & Redenbaugh, 1994) that starts the genetic transformation of plants of trade importance, the gene transfer in plants is aimed at improving both: characters of agronomic interest and of food nutritional quality (Prado et al., 2014). The most commonly pursued objectives from agronomical point of view are the introduction of genetically modified plants for acquiring herbicide-tolerance or resistance to insect attacks, diseases, abiotic stress factors (Barrows et al., 2014). We add nutritional change in these modifications such as of carbohydrate content, oil/fat composition, vitamins and certain types of proteins (Glass & Fanzo, 2017). Today agriculture for large commercial use can no longer be done today without the use of pesticides, without the use of selective seeds and without chemical fertilizers. Biodiversity and soil quality may become dramatically affected and even lost (Hladik et al., 2016). Taking into considerations the negative impact of the today pesticides, the needs for crops and for biodiversity conservation, it seems that modern biotechnology may provide key solutions for ending hunger at the global level (Nodoushani et al., 2015). The production of transgenic plants can be considered an extension of the ability of specialists to manipulate the cultivated plant species, the capacity on which our very existence depends.

GENETICALLY MODIFIED PLANTS FOR TERRESTRIAL TOLERANCE

By genetic engineering, tolerant or herbicide-tolerant crops can be obtained, the ways through which these desires can be achieved are: quantitative and qualitative variation of the herbicide target or introduction of a herbicide degradation system (Klümper & Qaim, 2014).

Modern agriculture recommends a series of herbicides whose action is plant emerging or post-emerging. If the application of the herbicide can be post-emerging, it allows the execution of the treatments only when it is needed when the weeds compete directly with the crop plants. The fact that there are such herbicides that allow us to apply them only if needed, and in very small quantities, which reduces costs on the product (Nicolia et. al., 2014).

For Romania some of other agronomic, economic and ecological advantages of cultivating genetically modified herbicide-resistant plants are considered such as: [1] creating the premises for a new option for post-emergence weed control, provided that all other methods and products remain valid; [2] as Roundup Ready and Liberty Link herbicides are rapidly biodegradable in the soil, decrease the remanence of toxic products for post-emergence crops and generally ensures weed control with minimal ecotoxicological effects; [3] increases the flexibility in choosing the moment of applying herbicides, this intervention can be done up to the blooming of crops; and [4] makes it possible to apply a broad spectrum of products including annual and perennial, mono and dicotyledonous weeds found in all developmental phases, including species that have become resistant to some active substances used so far, instead of several herbicides containing different Active ingredients (Badea, 2001).

GENETIC MODIFIED PLANTS FOR RESISTANCE AT THE ATTACK OF PATHOGENIC AND DAMAGING AGENTS

A major objective of agriculture is the cultivation of plants that are resistant to disease and pests. It is well established that the attack of various pathogens - viruses, bacteria, fungi - greatly reduces agricultural yields, almost equal to that produced by pests and weeds (Tschumi et al., 2016).

At present, combating diseases and pests in the main agricultural crops is done by applying fungicides and insecticides, by cultivating resistant varieties and by applying appropriate agro-technical practices (rotation of crops, autumn, etc.) (Pimentel & Burgess, 2014). These means also that we need to have several drawbacks, such as the creation of pathogens more resistant to pesticides.

Transgenic crops for disease resistance are still cultivated on small surfaces, transgenes whose products interfere, directly or indirectly, with the development of the parasite are used to obtain resistance to pathogens.

Obtaining genetically modified plants was initially achieved using genes of bacterial and plant origin. The most exploited source of resistance genes was the bacterium *Bacillus thuringiensis* (Bt), which is found in the soil and possesses the specific attribute to form, during spore formation, an insecticidal crystalline deposit, whose main component is the cry or delta-endotoxin protein. Insects integrates bacterial spores and associated crystals. The cry (cry protein) toxin attaches to specific receptors in the gut of certain insect species. Receptors

that do not exist in man, other vertebrates and all other invertebrates, including the useful ones. Following within minutes / hours of ingestion, the toxin destroys the intestine of the sensitive insect, which stops feeding (Badea, 2003). Today the process is more complex (Schünemann, ET AL., 2014).

GENETICALLY MODIFIED PLANTS FOR IMPROVING TECHNOLOGICAL QUALITIES

Another area that biotechnology scientists have turned to plant genetic modification for carbohydrate, vegetable oil, protein, vitamin other active principles composition.

In corn, potato, wheat and rice have been modified the starch content, given that for millennia these plants are used in human and animal nutrition. Starch is a reserve substance stored in vegetative organs or seeds and which ensures the survival of stems and tubers in winter and the development of embryos during germination. Also, it is a valuable resource for ethanol factories and not only (Cong et al., 2015).

Oil plants contain different amounts of fats in seeds - especially essential oils - the improvement of these plants is aimed at increasing the amount of oil and creating varieties with a composition of oil suitable for certain uses. Through genetic engineering, it has become possible to modify the composition and properties of vegetable oils with high precision and in a brief period. Rape is the plant on which genetically engineered, because in its seeds there is lauric acid, which is found in massive quantities in the seeds of tropical plants, especially in palms and coconuts. The laurel has properties that make it suitable for use in the cosmetics industry as well as in the food industry (Maheshwari et al., 2014).

Another concern of improving geneticists is that of increasing the nutritional value of different crop plants. The nutritional value related to certain proteins in plants used as food and / or feed can be modified by the increase in producing certain amino acids. The nutritional value of wheat used for human food can be doubled by adding 2 g of lysine / kg (Galili & Amir, 2013).

In 2015, 2 billion hectares of biotech crops, were cultivated in up to 28 countries annually, in a constant progression for the last 20-year between 1996 and 2015 and over 90% of the areas cultivated with transgenic plants are found in only 5 countries in North and South America - USA, Canada, Argentina, Brazil and Paraguay (ISAAA, 2016).

In the EU, only two transgenic crops are authorized to be cultivated, Monsanto's Bt corn, MON810 and BASF's Amflora potato. Maize has been genetically engineered to

produce its own toxin against the common pest *Ostrinia nubilialis* (corn stinging worm). Before 2007 Romania was cultivating 100,000 hectares of RR® soybean (Clive, 2007) and dramatically reduced this surface according to the EU regulatory framework/ Thus, today is currently one of the six EU countries cultivating genetically modified plants on small surfaces (i.e. in 2015 cultivated MON81 on 0 2.5 ha).

RISKS ASSOCIATE TO THE CULTIVATION OF GENETICALLY MODIFIED CROPS

Up to now, no scientific study has been able to clearly demonstrate that genetically modified crops could in any way harm the health of humans or animals. The advantage of these transgenic plants is that they provide a production increase of between 16 and 50% compared to traditional culture. Genetically modified plants have emerged over the last 20 years, so the risks they can pose to the environment are theoretically calculated. These reiterated risks could be: [1] the emergence of new pests, the crop plant that has been genetically engineered to be tolerant to salt could “escape” from the crop, could become invasive, removing indigenous natural vegetation; [2] enhancement of existing pest problems: crops are able of transferring genes at mileage to related species through wind or insect-mediated pollination, some of which may be known weeds. Thus, foreign genes from engineered crop plants, such as herbicide tolerance or dryness, could be transferred to weeds, making them even more difficult to control; [3] affecting non-target species such as viruses, micro-organisms, or genetically engineered plants to kill insect pests could also affect useful insects. In laboratory experiments, modified bacteria to convert plant residues such as leaves into alcohol for using it as fuel have resulted in the reduction of beneficial fungi populations. In some cases, grasses in neighboring areas were also killed by alcohol poisoning; [4] reducing biodiversity by replacing native species: GMOs crops that have a survival advantage may escape from crop fields, may invade other ecosystems and replace other species. This loss of biodiversity could severely diminish the ability of ecosystems or species to respond successfully to unexpected stasis, such as dryness or disease; [5] Wasting valuable biological resources: *Bacillus thuringiensis* (Bt) is commonly used as a natural pesticide. The researchers, however, have genetically modified many Bt crop plants and this could speed the speed with which different insects adapt and become resistant to Bt, making technology ineffective. Some mentioned risks on human health, through eating foods derived from genetically modified plants, such as: [1] existing analytical tests and databases containing

natural toxic substances or nutrients present in conventional foods are not appropriate to test unintended changes to GM derivatives; [2] genetic engineering can greatly affect toxins, allergens or nutrients in food; [3] allergies associated with food can be exacerbated by genetic engineering and [4] use of marker genes that confer resistance to antibiotics in some GM foods raises health problems.

CONCLUSIONS

Genetically modified crops continue to be cultivated in 28 countries for more than 30 years. If they are not cultivated in the rest of the world their products or products containing GMOs are commercialized all over the world. Implicitly all governments are not against the cultivation of the GMOs. Under the threat, of increasing the human population by 2050 up to more than 9 billion the food access will be at a stake and biotechnology may provide a nutritional food.

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THE ANALYSIS OF THE PATRIMONIAL-FINANCIAL SITUATION AT THE LEVEL OF A COMPANY

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Abstract:

The objectives of the financial analysis derives from the fundamental objective of the company's activity. For many years, the fundamental objective that dominated the economical thinking was „the maximum profit”, which brought huge damages to humankind on social and ecological level. Today the most used formulation in countries with a market economy is „the increase of the company's value”, which signifies the growth of the value of the shareholders wealth for the unlisted companies and that of the title exchange rate for the listed/quoted companies. It is obvious that such an objective implies a superior profitability, and in the same time the consolidation of the liquidities, of the solvency, of the financial balance. For Romania, in the present circumstances, the fundamental objective is „to assure the viability of the company in the conditions of sustainable development and of the internal and international competition”.

Key words: financial analysis, balance of account, assets, supplies, debts.

INTRODUCTION

The analysis of the patrimonial-financial situation at the level of the company has as objectives the study of the way self-financing in the conditions of decisional autonomy is performed, assuring the patrimonial integrity, an optimal ratio among its economical means, a normal achievement of the financial relations with other companies.

For the study we chose a company with the object of its activity is processing nutrients and food supplements, retailing food products, cosmetics, parapharmaceuticals, food supplements, etc. based on medicinal plants, wild fruits, mushrooms, etc.

THE DYNAMICS, SIZE AND STRUCTURE OF THE ASSETS BALANCE ACCOUNT

The data source for the analysis of the patrimonial-financial situation constitutes the synthesis of the accounting documents: accounting balance, the account of profit and loss and the annexes to the balance sheet.

The balance reflects the patrimonial situation at a certain moment, the beginning and result of the economical-financial flows of entrance, processing and output in the period taken into account for a budgetary year.

The economical-financial analysis based on the balance of account took into consideration the activity of two consecutive years aiming:

1. to determine the evolution of the balance of assets and its explanation minding the action of its composing elements;
2. to establish the changes that interfere the structure of the assets, in the relation between the composing elements.

THE COMPONENT ELEMENTS OF THE ASSETS OF THE ANALYZED COMPANY

ASSETS	Balance at Dec, 31.		Values in total assets	
	2015	2016	2015	2016
Corporal things	<i>54.619</i>	<i>128.781</i>	<i>31%</i>	<i>47%</i>
Stocks	25.838	35.978	15%	13%
Debts	91.951	104.243	53%	38%
House and bank accounts	2.478	6.287	1%	2%
<i>Circulating assets</i>	<i>120.267</i>	<i>146.508</i>	<i>69%</i>	<i>53%</i>
Total assets	174.886	275.289		

Based on the model of the structural analysis of the assets of the balance account and of the balance method, the explanation of the dynamics in absolute figures of the total patrimony of the company analyzed by the action of the economical means from the assets of the balance account implies the following calculations and formulas:

$$\Delta A = A_i - A_0 = 275.298 - 174.886 = + 100.403;$$

$$A_1 = \text{year 2016};$$

$$A_0 = \text{year 2015}$$

Out of which because of the action

1. immobilized assets

$$\Delta A_{Ai} = A_{i1} - A_{i0} = 128.781 - 54.619 = +74.162$$

2. circulating assets.

$$\Delta A_{(AC)} = A_{C1} - A_{C0} = 146.508 - 120.267 = +26.241$$

Taken down synoptically, the results of the structural quantifications are as such:

$$\Delta A = 100.403 \text{ lei out of which:}$$

$$\Delta A_{Ai} = 74.162$$

$$\Delta A_{(AC)} = 26.241$$

We registered a growth of the assets compared to 2015 with 100.403 lei respectively of 1.57 times which, as a principle constitutes a positive result as it marks the development of the activity. Taking into account the inflation index which was of 7%, the increase of the asset is of 48%, a significant value.

This increase is 73.86% due to the growth of the corporal things and 26.14 % to the growth of the circulating assets.

The coefficient of the corporal things, 47%, is raised due to the technical outfits rather expensive at the level of the studied company.

Regarding the circulating assets, one may notice an increase of the stocks, a phenomenon that is considered normal in the circumstances in which the activity of this company may be considered a company with seasonal activity, taking into account the object of its activity. Other causes that keep the company in the normal sphere is the deliberate establishing of some reserves in conditions of price fluctuations and the formation of stocks of finite products to enter new markets.

CONCLUSIONS

Although the volume of the debts increased in the analyzed period, it rightly fits into the normal course of the economical circuit and the debts are doubtless.

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THE ACTION OF THE COMPONENT ELEMENTS INSCRIBED IN THE LIABILITIES OF THE BALANCE OF ACCOUNT

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Abstract

The changes that appear in a given period in the financial resources of the company to constitute its economical means may be explained via the action of the component elements inscribed in the liabilities of the balance.

Key words: accounting financial analysis, balance of account, own capitals, debts.

INTRODUCTION

The presence of the financial resources represent the premises of every economical action.

THE DYNAMICS, VALUE AND STRUCTURE OF THE LIABILITY OF THE BALANCE OF ACCOUNT

The study will consider:

- a) the dynamics of the total patrimony of the company and its explanation via the action of the component elements aiming to finance the economical means, reflected in the liability balance account
- b) changes that appeared in the structure of the patrimony respectively in the ratios between its component elements reflected in the liability balance.

The data used are extracted from the balance of the company.

Table 1

The component elements of the assets of the analyzed company

ASSETS	Balance at Dec, 31.	
	2015	2016
Corporal things	54.619	128.781
Stocks	25.838	35.978
Debts	91.951	104.243
House and bank accounts	2.478	6.287
<i>Circulating assets</i>	120.267	146.508
Total assets	174.886	275.289

Table 2

The component elements of the company’s liabilities

LIABILITIES	SYMBOL	Balance at Dec, 31.	
		2015	2016
<i>Own capitals out of which:</i>	Cpr	75.644	84.239
Social capital	Cs	500	500
Reserves	R	75.144	83.739
<i>Debts</i>	Doc	99.242	191.050
Total liabilities		174.886	275.289

Based on the structural analysis model and on the balance method, the explanation of the absolute figure dynamics of the total patrimony via the financing resource action from the account assets considers the following formulas:

For the period 2015 - 2016

$$\Delta P = P_1 - P_0 = 275.288 - 174.886 = 100.403$$

out of which due to action:

1. own capitals

$$\Delta P (C_{pr}) = 84.239 - 75.644 = 8.595$$

2. $\Delta P (D_{oc}) = 191.050 - 99.942 = 91.808$

In the analyzed period the total patrimony of the society reflected in the liabilities that express the financial resources of the circulating means registered a growth of 100.403 lei as a result of the debts increase.

As a positive phenomenon we mention the increase of the own capital. As a counter balance we registered an increase of the total debts fact that is a signal of the society solvency.

The global economy ratio analyzes the financing of the society’s assets and proves the weight of the own sources on long term liabilities: $84239/275289 \times 100 = 30\%$ (for 2016). The society was in a situation close to the normal if we take as control the general appreciation which establishes that 33% is the level that represents a normal situation.

The correlation between the net assets and the financial resources for its establishing:

$$A_n = (A_i + A_c) - D;$$

A_n = net assets;

A_i = total immobilized assets

A_c = total circulating assets;

D = total debts (out of the liabilities)

The net assets 2015 = $54.619 + 120.265 - 99.242 = 75.644$

The net assets 2016 = $128.761 + 148.506 - 191.050 = 86.217$

Essentially the net assets represent the capital/wealth of the society in a certain moment. A marked increase is to be noticed compared to the proceeding period of 10.573 (which represents 12%), determined mainly by the increase of the asset elements. The attention and the amplification of the obligation degree of the society are to be noticed.

In this situation one may say that the wealth of the society has grown and that there is the possibility (at least on the records) to cover the debts it has.

CONCLUSIONS

Given the situation, for the leading board of the society the main objectives must be the corresponding capitalization of the patrimonial elements, stock reduction and the acceleration of collecting the claims to create the financial reserves necessary to pay the obligation. Otherwise one has to take new loans, which, because of the levels of interests, may affect the financial situation of the society.

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THE ROLE OF CLIMATE IN SUSTAINABLE DEVELOPMENT OF PĂLTINIȘ RESORT

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Abstract

Climate is an important constituent of tourism's natural potential, promoting or inhibiting the organization and conduct of tourism activities. Climate often imposes how to conduct tourism activities. Many types of recreational activities are dependent on climate: heliotherapy depends on the sunshine duration, skiing depends on the thickness and duration of the snow cover etc. In terms of touristic potential, the climate must be viewed in two ways: as a landscape factor and as the influence exerted by it on the human body. The impact of climatic elements manifests very differently on the people's bodies that participate in the phenomenon of tourism, causing a "selection" of the categories of people who can benefit from a stay in the ambience of various natural regions from a physiological point of view.

Key words: tourism, climate index, bioclimate, Păltiniș resort

INTRODUCTION

Characterization of mountain tourist area Păltiniș - Cindrel (Sibiu County) Tourist Area Păltiniș - Cindrel is located in the southern county of Sibiu and overlaps administrative units Sibiu, Poplaca and Rășinari, revolving around a major urban centre, Sibiu municipality, to which Păltiniș resort is located 30 km direction SV. Păltiniș resort of national interest was set at 1400-1452 m altitude, and the natural conditions present significant potential of international approval as a receiving area for tourists. Among the geographical factors, the relief has a determinant role in the rainfall regime, establishing itself by altitude, slope orientation, slope and configuration of its forms. The altitude causes vertical change of all climatic elements. Rainfall grows, as the altitude increases, up to a certain height called pluviometrical optimum beyond which begin to decrease. The slopes print differences between the southern slopes that receive lower amounts of precipitation, compared to the north, where rainfall is higher. The slopes safe from the general circulation of the atmosphere (eastern slopes) receiving smaller amounts of rainfall, compared to Westerners. Tilting the slopes has a role in the differential heating surfaces with different slopes, hence resulting in the role in rainfall distribution. Climate change causes relief configuration elements. The forms concave (depression, colour valley) temperature inversions occur frequently, persistent frost, wind is less and less rainfall. The convex shapes (ridges, peaks), the wind speed

increases and orographic convection, with significant implications in enhancing rainfall. The mountainous area has a specific climate with average annual temperatures lower in this case are typical rainfall and cool summers with cold winter with heavy snowfall and snow longer. The hilly summers are hot, relatively frequent rainfall, as warmer intervals.

MATERIAL AND METHODES

General circulation of the atmosphere is characterized by high frequency of intake air temperate oceanic in the West, especially in warm weather and low frequency of continental temperate air from the northeast and east. The air temperature is influenced much relief altitude. Meteorological data collected by the weather station Păltiniș (1453m) indicates an average annual temperature oscillating around 5°C. The average temperature in July is 13.4°C in Păltiniș and 7-8° in the ridge area. Highs exceeded 30°C and 22°C in Păltiniș on the highest peaks. Average number of days of frost is 155.2 in Păltiniș and over 200 in the ridge of the mountains. Rainfall is generally higher as the altitude is higher. Average annual Păltiniș is 906,1mm and 1200 mm on the highest peaks; monthly average amounts biggest fall in June and are 153mm to 150mm Păltiniș and around 2,000m.Cantitățile the lowest average monthly fall in February, 41.5 mm in Păltiniș and 50 mm in high mountain area. The highest amounts of rainfall in summer are frequently accompanied by thunder. Maximum levels have fallen in 24 hours cumulative 98.3 mm in Păltiniș resort. Winds are influenced much relief. Păltiniș prevailing winds from the W, SW and E, and the highest peaks of V and NV winds dominate. The average annual frequency of calm is small in mountainous sector, 18.3% to the resort. Annual average speeds range between 1.5 - 6.5 m/s. In late winter and early spring from the mountain beat "Big Wind" warmer, causing heating sharp and sudden melting of snow. Considering the specific agro-pastoral area of the territory Păltiniș - Cindrel, environmental quality improvement component depends on encouraging environmentally friendly practices.

In analysing the bioclimatic characteristics of Păltiniș resort several indicators were selected (resulting from combining several climatic factors), relevant to stress the level of favourable climate of the area studied: thermal comfort index or TEE, temperature-humidity index (THI) and bioclimatic stress index of skin, lung and global. From the analysis of climate data string of Păltiniș weather station situated at an altitude of 1443 m, between 2005-2014, for June, July, August and September at 13 hours (when tourism activity is particularly intense), the conclusions are the following: thermal comfort (even at lunch hours) is reached with low frequency in all summer months. Thus, in July thermal comfort is recorded at

Păltiniș with a frequency of 2%; heat discomfort is not reached as a monthly average in Păltiniș (rather as a daily average) yet discomfort by cooling reaches high values: 29% in July. The temperature-humidity index for Păltiniș was calculated at 13 hours (June, July, August and September between 2005 and 2014) and only the feeling of comfort was recorded.

Temperature-wind index was calculated at 13 hours (in all the months of the year, although the negative effects exist only in the winter) in the period 2005-2014 for Păltiniș weather station. It was found that the monthly mean values had only recorded the feeling of comfort and light discomfort, but there were days when the index had negative values. Thus, in February 2009 the lowest average was registered ($-3,5^{\circ}\text{C}$, increased discomfort) and on the 12th and 13th calorie stress had been observed. Bioclimatic Stress Indices highlights the main meteorological factors influence on the human body and how it reacts to maintain steady heat (warm-blooded), i.e. constant temperature of the human body. Bioclimatic stress has three components: coetaneous stress, lung stress and global stress. To calculate these indices it is used the average daily values for the following climatic parameters: temperature ($^{\circ}\text{C}$), atmospheric water vapour pressure (hPa) and wind speed (m/s). For Păltiniș, were obtained monthly average of skin stress that reveals bioclimatic with hypertonic stress in January, February and December, and the rest of the year balanced. In 2005 in June, July, August and September were recorded hypotonic stress. Five months (April-June and September-October) are relaxing with a tonic effect, stimulant, training and the opportunity to spend time outdoors through specific tourist activities (hiking, cycling). In terms of lung stress index (which has value 20) is also reduced, it varies with altitude less than index stress skin. The balanced months of the year are May-June and September-October. The interval from November to April index recorded a desiccant, positive, stimulating action, drive and conducive to winter sports.

RESULTS AND DISCUSSIONS

For the tourism operator it is worthy of note that some extreme values of climatic elements can be stressful for tourists (long exposure to strong radiation, cold, heat, dryness, moisture, strong wind, low pressure). Also, some excessive weather variations produced in a short, sudden time are considered stressful for the body. Bio-climates form the basis for the climate-therapy's existence and development, the climatic treatments and tourism.

The temperature effective equivalent index ($^{\circ}\text{TEE}$) reflects the actual temperature felt by the body at a time, under certain conditions of temperature, degree of humidity and air

movement in the atmosphere. This index allows the weather conditions of the moment, to dose the indicated heat capacity of air for the tourists' bodies, so that at the end of the treatment to obtain a trained and a tough body, from a thermic point of view. It is considered that the thermal comfort zone (neutral zone) is between 16.8° and the effective equivalent temperature of 20,6°C (°TEE). Between this temperature range, under normal conditions and a relaxed dress code, whose albedo is an average one in a position of rest, the body does not register significant gains or losses of heat. Below or above this range, the body has the feeling of cold or heat, which brings metabolic changes in order to maintain internal body temperature (thermal homeostasis) constant [1]. The Classification of air baths according to the TEE includes as follows: cold air baths 1° - 8,9° TEE; moderate cold air baths 9 ° - 16,8°TEE; comfortable air baths 16,9° - 20,8°TEE; moderate warm air baths 20,9° - 22,9°TEE; hot air baths 23 - 27°TEE; very hot air baths > 27°TEE.

Table 1

The Frequency (%) of the equivalent effective temperatures (°TEE) in Păltiniș Resort for the period 2005-2015 (at 1 PM)

Months	Thermal comfort	Discomfort-Heating	Discomfort-Cooling
June	0,1	-	29,9
July	2,0	-	29,0
August	2,8	-	28,2
September	0,8	-	29,2

Source: processed weather forecast data

From the analysis of data string climate stations in the studied area, located at an altitude of 1453 m (Păltiniș meteorological station) and at an altitude of 430 m (Sibiu meteorological station in Sibiu's Depression), between 2005-2014 for June, July, August and September at 1 PM (when tourism activity is particularly intense), the conclusions are: thermal comfort in Păltiniș (even at lunch hours) is performed with low frequency in all summer months.

Thus, in July, thermal comfort is recorded at Păltiniș with a frequency of 2%, while in Sibiu it achieves a rate of 10.6%; heat discomfort is not reached as a monthly average in Păltiniș (just as a daily average) and discomfort by cooling achieves very high values: 29% in July, while in Sibiu is only 11.9%. The highest monthly average equivalent temperature was registered in July 2005 when discomfort heat was reached on 6, 7, 11 and July 23.

The existent situation in Păltiniș is due largely to relatively low air temperature, and wind speeds above 3.5 m/s. At speeds above this value, wind is an unfavourable element of thermoregulation.

Table 2

The frequency (%) of the positive and negative temperature in Păltiniș and Sibiu (1999-2015)

Weather station	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Annual
Sibiu +	29	42,6	79,6	98,8	100	100	100	100	100	99,4	79,1	44,6	81,1
-	71	57,4	20,4	1,2						0,6	20,9	55,4	18,9
Păltiniș +	18,4	24,7	35,2	80	96,5	100	100	100	99,7	94,5	73,4	28,4	71,5
-	81,6	75,3	64,8	20	3,5				0,3	5,5	26,6	71,6	28,5

Source: processed weather forecast data

Table 3

The value of the equivalent temperature index in July 2005 in Sibiu and Păltiniș

Weather station	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Annual
Sibiu +	29	42,6	79,6	98,8	100	100	100	100	100	99,4	79,1	44,6	81,1
-	71	57,4	20,4	1,2						0,6	20,9	55,4	18,9
Păltiniș +	18,4	24,7	35,2	80	96,5	100	100	100	99,7	94,5	73,4	28,4	71,5
-	81,6	75,3	64,8	20	3,5				0,3	5,5	26,6	71,6	28,5

Source: processed weather forecast data

The temperature - humidity Index (ITU) is calculated dimensionless (in units) taking into account the temperature and the relative humidity of the air. Significant values start from the threshold where the discomfort is high (80 units respectively 40°C). Depending on the values obtained by calculations for ITU (expressed in value units) the following states may be established: ≤ 65 - state of comfort; 66-79 – state of alert; ≥ 80 –state of discomfort. ITU values, that range from <40 to > 85 reflect the physiological sensations of thermal comfort felt by the human body through the combination of the physical processes of heat transmission by radiation, convection and evaporation of water from the skin.

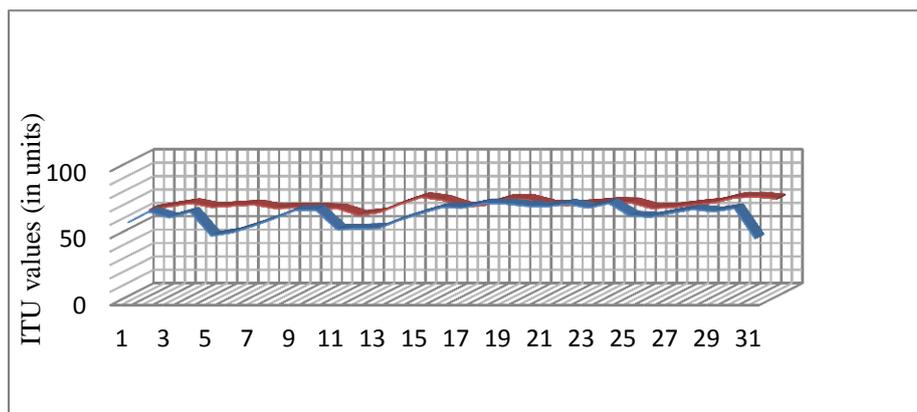


Fig. 1 The daily value of the temperature-humidity index in Păltiniș (July 2013, August 2008)

The Temperature-humidity index was calculated at 1 PM (in June, July, August and September 2005-2014) for Păltiniș station and there was only recorded a state of comfort. From the analysis of the data resulted from calculations in the studied region, it appears that almost the entire period of the year falls into a state of thermal comfort. In two months, July 2013 and August 2008, there were quite high average values and in any of those days the critical threshold of 80 units was not reached, but only the alert status [7].

The use of this index reveals that, in the studied territory, the periods which induce positive effects on the human body are throughout the year. This allows tourist activities throughout the year, with their differentiation depending on the season and the participants' preferences. The wind chill index IR is called the equivalent temperature of wind chill power-IR. This is the temperature that air would reach at some certain values of the wind speed.

Table 4

The wind chill power, the equivalent temperature of the wind chill power and the induced physiological effects of the latter

Wind Chill Power P(W/M ²)	Equivalent temperature of wind chill IR (° C)	Physiological effects
P = 200-399	IR>+10	No discomfort
P = 400-599	+9,9>IR>-0,9	Slight discomfort
P = 600-799	-1>IR>-9,9	Emphasized Discomfort
P = 800-999	-10>IR>-17,9	Very cold
P = 1000-1199	-18>IR>-28,9	Hypocaloric stress
P = 1200-1399	-29>IR>-49,9	Frostbite discomfort in prolonged exposure conditions
P >1400	IR<-50	The risk of instant frostbite

Source: processed after Ionac N., 2008 [4]

P value's intervals correspond to certain interval values of IR. The effects of P (and the related IR) on human physiology depend on the intensity of caloric losses suffered by the human body.

Table 5

Daily value index of wind chill power IR (° C) in February 2004 in Păltiniș

Day	1	2	3	4	5	6	7	8	9	10
February 2004	-4	-2,3	2	-0,4	-3,1	2,1	8,5	2,8	-13,8	-16,8
Day	11	12	13	14	15	16	17	18	19	20
February 2004	17,1	-18,2	-22	-12,2	-8,8	-2,1	-1,3	-0,3	-8	1,2
Day	21	22	23	24	25	26	27	28	29	
February 2004	7,8	8	6,3	-14,2	0,9	9,1	2,8	-5,1	-2,1	

The temperature-wind index was calculated at 1PM (in all months of the year, although the effects are negative during winter) in the period 2005-2014 for Păltiniș station. It was found that the monthly average values recorded only the state of comfort and light discomfort (in January, February, March, April, November, December), but there were days when the index recorded negative values. Thus, on February 2009 the lowest average value was registered (-3.5° C, increased discomfort) and hypocaloric stress in days 12 and 13.

Depending on the values obtained by calculating the chill index, the following ranges were established: 0-299 - hypotonic index, during summer, requests triggering thermolysis during summer; 300-599 - relaxing index, optimal treatment of the weather; 600 - 1500 – hypertonic index, during winter, requires triggering thermogenesis during the cold season [2].

For Păltiniș, monthly average values of the cutaneous stress were obtained, values that reveal a bioclimat with hypertonic stress in January, February and December, and a balanced one in the rest of the year. In 2005 in June, July, August and September hypotonic stress was recorded.

The landmarks with sports facilities and leisure along with the ones for accommodation and entertainment and events play a critical role in the development of the resort. The most important long-term goal in this area is the development of activities of winter sports, along with those that can take place all year round. Access areas on the slopes, containing specific facilities for winter sports are special components in the spatial organization of the resort. Tourist reception facilities are a category of prime importance in the resort and in the surrounding area, their distribution and typology being essential for the successful development of Păltiniș to overcome the/a weekend tourism level/destination.

Stimulating an economy of tourism, sustainable and balanced based on local resources, the cooperation in the area of administrative units and training local economies will determine the improvement of living standards of the communities in the area by creating jobs in local economies. It is also necessary to upgrade the tourist infrastructure, consistent with environmental improvement and complying with the protection and preservation of the natural and built environment.

The mountainous area of Sibiu falls into the category of non-conventional destinations, being frequented by relatively young people who opt for hiking or sports, as well as those who prefer rest and recreation in the natural environment [8]. A special category of foreign/non-local tourists represent those who combine many types of tourism (leisure, cultural, business, visits to relatives and friends, events) and who change in the course of a holiday, more/various destinations and accommodations. The priority on the development of Păltiniș - Cindrel resort and surroundings is the development of the ski area. Păltiniș is a settlement with predominantly tourist functions, the importance of which will be amplified in the future [3].

The majority of Păltiniș resort's accommodations are in hotels, while approx. 20% are in pensions and the remaining ones (vs 'the rest are rest houses') rest houses. This is relatively unfavourable for a mountain resort frequented largely by young people (44% of tourists throughout the county are between 26 and 45 years), whose incomes and interests are not consistent with the offer of accommodation and food in the resort [5].

The offer of hotel accommodation and meal at the restaurants is more appropriate to/for foreign tourists, which however account for only 30% of the visitors to the county, which is offering few activities, thus foreign tourists have an average duration of stay of less than the domestic ones (2.67 days vs 3.28 days for foreign and Romanians respectively). The administrative territory of Păltiniș resort has an area of 296 ha, which offers potential for development for at least 3000 people (calculated with an average population density of 20 person / ha for the actually built area, which is specific to other/some settlements in the area and taking into account that it is 1/2 of the total area of the resort), that is, approx. 6 times its current capacity of receipt/accommodation. The maximum occupancy of the accommodation units is of the order of 5,000 seats, estimated relative to the ski area, valued at a total capacity of approx. 7000 skiers. Assuming the resort accommodates 50% of the area's total capacity (10,000 people) and rate of occupancy in the resort is at maximum 70%, the other half is supposed to be made up of tourists staying in nearby localities/settlements and of one-day

tourists. Creating and expanding ski resorts integrated in local ecotourism networks provides numerous jobs and business opportunities for local communities which weakens this kind of pressure on the environment and, most importantly, motivates communities to conserve the landscape and to preserve the attractiveness of the tourist area in question [5], [6].

CONCLUSIONS

There is a local climate for every place, characterized by a certain regime of meteorological factors to which the natives' bodies are acclimated. For those people that come for treatment or for rest in a balneary resort, the weather acts on their bodies in the first days by adaptation and acclimatization reactions, more or less intense, depending on the geographical area from which the subject is coming. In determining the climate's favourability for tourism in Păltiniș resort and its surrounding areas, it is necessary to know the values of the bioclimatic indices. The most often used climatic parameters are temperature, air humidity and wind speed. They are used in different combinations and formulas and the targeted result are the same every time - determining the degree of climatic comfort for the touristic activities' participants, and the main types of topo climates, favourable or less favourable for performing touristic activities or human activities in general.

The state of comfort is stimulator for rest and practicing various touristic activities. The state of discomfort - depends on the intensity of the climatic factors' actions – this can translate into stress that can be reduced, stimulated, of adaptation and acclimatization, but also an increased long lasting stress, that can induce danger for human health or as in this instance for tourists.

In analysing the bioclimatic characteristics of Păltiniș resort and the near rural areas, several indicators were selected (resulted from combining several climatic factors), relevant to point out the level of the climatic favourability of the studied area: the thermal comfort index (TEE), the temperature-humidity index (THI) and the bioclimatic stress index. We consider that the monthly multiannual averages from the last 15 years are enough for highlighting the dynamics of climatic phenomena and their influence on activities and types of tourism, a period in which there are more arguments in terms of climate indicating favourability of climate for tourism in the Cindrel Massif.

In terms of climate change, the adaptation of the product offered by weather conditions in vulnerable areas is of great importance, as it is the case of mountainous areas. From a bioclimatic point of view the characterization through bioclimatic indexes (the

equivalent temperature index, the temperature-humidity index and the temperature-wind and bioclimatic stress index) from Păltiniș resort and neighborhood areas highlights that there is a very favourable bio-climate for practicing tourism. Thus, in terms of a cutaneous aspect, the stress index is quite low compared to that from high altitudes (in Omu Peak, the value of this index is 140). Five months of the year (April-June and September-October) are relaxing with a tonic, stimulant, and training effect and the opportunity to spend time outdoors through specific touristic activities (hiking, cycling). Regarding the pulmonary aspect the stress index is also low, 20 (compared to that of the Omu Peak which is 40), varying less than the altitude compared to the cutaneous index. The Balanced months of the year are May-June and September-October. The interval from November to April recorded a desiccant index, positive, having a stimulating action, of drive and practice of winter sports.

So far, Păltiniș has been shaped primarily for recreation, for tourism, except the period from the beginning, when the resort had a balneary aspect as well. Strong lightens small values of cloudiness and air pressure moderate bioclimatic indices may be exploited for treatment and prophylactic cures in the resort, particularly in the treatment of the respiratory tract, endocrine, asthenic neurosis, rickets and growth disorders in children, and some skin diseases as well. Păltiniș resort's bioclimat and the one from the touristic villages on Cindrel Mountains frame can be utilized in a prophylactic and therapeutic way to treat rickets and growth disorders in children (in this sense organizing holiday camps is benefice). It is even recommended the establishment of a sanatorium for children and for people who suffer from asthma in the place where the intersection with Șanta occurs. Păltiniș Resort is recommended for some dermatological diseases through the cure of heliotherapy and aero therapy.

With a high bioclimatic potential, the Păltiniș resort and the adjacent area may become not only places of touristic interest, but places of a balneary interest, regaining in this manner their place in the national touristic circuit.

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PROTECTED INSECTS OF COMMUNITY INTEREST FROM THE "DUMBRAVA SIBIULUI" FOREST, SIBIU COUNTY

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Abstract

The identified species are mentioned in the European (Berna Convention, Habitats Directive 92/43/CEE) and Romanian legislation (Order no.1198/2005, Ministry of the Environment and Waters Management). According to IUCN regulations, the species degrees of endangered have been submitted too.

Twelve species of protected insect, of community interest, from the orders: Lepidoptera (six species), Coleoptera (five species) and Orthoptera (one species), identified in the area "Dumbrava Sibiului" Forest. This work is based on data published in the specialist papers, and on the original researches obtained from the insects gathered in the years 1904-2015, and preserved at the Natural History Museum in Sibiu.

Key words: comunitary interest, protected insects, "Dumbrava Sibiului" Forest

INTRODUCTION

Forest "Dumbrava Sibiului" is in Sibiu in Sibiu Depression at the contact between the lens Cindrel Mountains and sediment basin itself and now occupies the plain foothills and piedmont hills, located in the south-west section of Sibiu (Fig. 1). It has an area of 978 ha divided into four bodies forest and stretches from the outskirts of Sibiu Rășinari village in South and to Poplaca in West surrounded by pastures, meadows and arable land. Studies about the entomofauna in Dumbrava Forest of Sibiu about different insect orders were carrying by Bucșa who studied between 1988-2015, xylophages coleoptera species (Bucșa 1988, 1995, 1996, 1997, 2002, 2004, 2005), Stancă-Moise Macrolepidoptera, publishing several articles between 2001-2016 (Stancă-Moise, 2002, 2003,a,b, 2005,a,b,c,d,e,f, 2006 a,b, 2007 a,b,c, 2012, 2015a,b). The first monography of Macrolepidoptera diurnal species that contains data and collections about lepidopetra was made by the author in 2012. Studies on populations of Coleoptera were made between 2014-2016, and the research results were published in several papers (Stancă-Moise, 2013, 2014, 2015a,b,c). Species belonging to other groups of insects collected from "Dumbrava Sibiului" Forest appear in the collections of several authors as:



Fig. 1. The satellite map of "Dumbrava Sibiului" Forest (adapted after Google Earth)

MATERIAL AND METHOD

Material underlying this paper is given as part of the species preserved in entomological collections of the Natural History Museum in Sibiu, or collected by the author from "Dumbrava Sibiului" Forest. These data are added to the previous alert from the literature (Cupezan et. al., 2015), as well as scientific observations made by the author in the mentioned zone.

Signaled species are listed in systematic order, after family according to the taxonomy of fauna Europaea. For Lepidoptera I respected the taxonomy and nomenclature from the work (Rákosy et. al, 2003).

For every species were noted: the international conventions under whose objectives are Order 1198/2005 (abbreviated in brackets), personal data (for species that I ordered unpublished data, they were listed in alphabetical order, in chronological order of the collected data, earlier alerted in Forest Grove, brief data about the biology and ecology of the species, mentioning bibliographical sources, where those interested can find comprehensive information concerning this issue, distribution and safeguards species.

The following abbreviations are used in the text:

Ber-2, strictly protected fauna species recorded in the Berne Convention (Law 13/1993)

Ber-3, protected fauna species recorded in the Berne Convention (Law 13/1993)

HD-2, Conserved species of Community interest whose conservation requires the designation of specific habitat, Habitats Directive 92/43 / EEC / 1992

HD-4, preserved species of Community interest requiring strict protection, the Habitats Directive 92/43 / EEC / 1992

3^A, animal and plant species that require strict protection, community interest, recorded in MMGA Order NO. 1198/2005

CRL presence of Lepidoptera species in the Red Book of Lepidoptera of Europe

DC = Daniel Czekelius Lepidoptera collection, **EW** = Eugen Worell Lepidoptera collection, **VW** = Viktor Weindel Lepidoptera collection, **HH** = Heinrich von Hann Hannenheim Lepidoptera collection, **RW** = Rolf Weyrauch, **CM**-Cristina Moise, lepidoptera collection. The species from Dumbrava Sibiu Forest, Sibiu County and Their status According to the Romanian Red List (**NT** - Near threatened; **VU** -Vulnerable, **EN** - Endangered).

RESULTS AND DISCUSSIONS

Protected species identified in the area of Oak Forest Grove Sibiu belong to orders: Lepidoptera (6 species, 5 genus), Coleoptera (5 species and 5 genus) and Orthoptera (one species and one genus). They were collected sporadically over 176 years, during the years 1840 -2016, but mainly in the last years of this period.

Analyzing data summarized from the literature consulted on the analysis in this paper, I noticed that there were no systematic studies undertaken in the area. Thus, the work of the Transsylvania Published by Dr. D. Were Czekelius [Czekelius (1897, 1917)] in “*Verhandlungen und Mitteilungen des siebenbürgischen Vereins für Naturwissenschaften zu Hermannstadt*”. Even after this year, there are few papers that contain data from this area.

However, some species of beetles indicated by (Cuzepan G., Tăușan I., 2013) Forest Grove city, such as *Rosalia alpina*, *Lucanus cervus* and *Morimus funereus* were found and the author (Stancă-Moise, C., 2015c) in the analyzed material, included in year 2015, in forest Grove area of Sibiu, which shows that human activity has not affected much the preferred habitat of species listed above.

However, some species of lepidoptere as *Lycena dispar rutila* in 1879 by Daniel Czekelius and *Maculinea arion* since 1840 by Eugen Worell were reported in the area. According to researches until 2016, we found that these species are present even today in entomofauna of Sibiu Dumbrava Forest. Species: *Colias myrmidone* reported since 1907 by Daniel Czekelius and *Maculinea nausithous* are present in this area since 1922.

Table 1.

The Order	Taxonomic identified protected species			Status IUCN
	The Family	Genres	Species	
LEPIDOPTERA	PAPILIONIDAE	<i>Parnassius</i>	<i>P. mnemosyne</i>	NT
	PIERIDAE	<i>Colias</i>	<i>C. myrmidone</i>	VU
	LYCAENIDAE	<i>Lycena</i>	<i>L. dispar rutila</i>	VU

		<i>Maculinea</i>	<i>M. arion</i>	NT
			<i>M. nausithous</i>	CR
ORTOPTHERA	ARCTIIDAE	<i>Euplagia</i>	<i>E. quadripuctaria</i>	-
	TETTIGONIIDAE	<i>Pholidoptera</i>	<i>P. transsylvanica</i>	-
		<i>Cerambyx</i>	<i>C. cerdo</i>	VU
COLEOPTERA	CERAMBYCIDAE	<i>Rosalia</i>	<i>R. alpina</i>	VU
		<i>Morimus</i>	<i>M. funereus</i>	VU
	LUCANIDAE	<i>Lucanus</i>	<i>L. cervus</i>	LR
	SCARABAEIDAE	<i>Osmoderma</i>	<i>O. eremita</i>	VU

Order: **LEPIDOPETRA**

Superfamily **PAPILIONOIDEA**

Family **PAPILIONIDAE** Latreille, [1802]

Subfamily **PARNASSIINAE** Duponchel, [1835]

Parnassius mnemosyne Bryk, 1925 (**Ber-2, HD-4, NT, 3^A, CRL**, Foto. 2)



Foto. 2. *Parnassius mnemosyne*
 (<https://www.google.ro/search?q=Parnassius+mnemosyne>)

Biogeographic region: Europe, the Caucasus, Transcaucas, Middle Asia, Kazahstan.

Habitat type(s): wooded steppe, bush areas, limestone areas steppe meadows, karst canyons.

Status: very local, common and very common. **Altitude:** 0-800 m. **Flight period:** V-VI. **Protection status:** VU. **Larval food plants:** they are feeded exclusive with *Corydalis solida*,

C. cava, *C. intermedia* leafes. **Overwintering stage:** hibernates in egg stage.

Migratory status: non migratory. **No. specimens collected:** 22.V.1904, 13.VI.1954 V. W.

Literature: Köing 1975, Niculescu 1960, Rákosy&Wieser, 2000, Rákosy, 1997, Rákosy&Székely, 1996, Székely, 1992, Corduneanu, 1991, Skolka, 1994.

Protection measures: to forbid collecting species by collectors, protecting the preferred habitat.



Foto. 3. *Colias myrmidone myrmidone*
 (<https://www.google.ro/search?q=Colias+myrmidone+myrmidone>)

Family **PIERIDAE** Duponchel, [1835]

Subfamily **COLIADINAE**, Swainson, 1827

Colias myrmidone myrmidone (Esper, 1780), (**VU, 3^A, CRL**, Foto. 3.)

Biogeographic region: Europe (Austria, Bulgaria, Czech Republic, Poland, Moldova, Russia, Hungary, the Caucasus), Altai province, Little Asia. **Spreading in Romania:** Transylvania, Moldavia, Banat, Oltenia, Dobrogea. **Habitat type(s):** grasslands, meadows, bush areas. **Status:** common.

Altitude: 400-1200 m. **Flight period:** V-VI. **Protection status:** VU. **Larval food plants:** *Cytisus ratisbonensis*, *C. capitatus*.

Overwintering stage: hibernates in larva stage. **Migratory status:** Migratory. **No. specimens collected:** 2 ex.; 29.V.1921 VW; ♂, 12.VII; 26.VII.1907 DC; 4♀♀, 21,25,29,30.V.2001, 3♂♂ 6.VIII; 18.VIII.2013; 22.VIII. 2015 CM; 2♀♀, 15.VII.2011; 18.VIII. 2011 CM; 29.V.1921, 31.VI.1907 (V. Weidel).

Literature: Popescu-Gorj, 1964; Köing 1975; Căpușe&Kovács, 1987; Niculescu 1963, Ciochia-Barbu, 1980; Stănescu, 1995; Burnaz, 1993; Skolka, 1994. Collectors data and information from specialized literature shows that the presence of this butterfly was alerted at least in 75 locations on Romanian terrain; after year 2000 could be found in 12 locations, but after year 2005 just in 5 locations. Nowadays, there are known just 2 more big and stable populations, one of them in "Depresiunea Giurgeului" and the second one in Gilău Mountains, therefore also these populations are exposed to endanger because of human intervention from the last 3-4 years.

Protection measures: preserving and protecting the species preferred habitat, avoiding chemical treatments, forbid collectors from collecting the species.

Family LYCAENIDAE [Leach], [1815]

Subfamily LYCAENINAE [Leach], [1815]

Lycaena dispar rutile (Werneburg, 1864) (HD-2, HD-4, Ber-2, VU, 3^A, CRL, Foto.4.)



Foto. 4. *Lycaena dispar rutile*
(<https://www.google.ro/search?q=Lycaena+dispar+rutile>)

Biogeographic region: South-East Europe, Germany. **Spreading in Romania:** Transylvania, Moldavia, Banat, Oltenia, Doblodja, spread in all provinces of Romania. **Habitat type(s):** wet meadows, swampy meadows, moorlands, lakesides, fool areas. **Status:** localized, common. **Altitude:** 200-1200 m. **Flight period:** ½ V- ½ IX. **Protection status:** VU. **Larval food plants:** *Rumex hydrolapathum*, *R. aquaticus*, *R. crispus*, *R. obtusifolius*.

Overwintering stage: hibernates in larva stage. **Migratory status:** non migratory. **No. specimens collected:** 2.VIII.1907, 1.V.1927 (V. Weidel), 11.VI.1879 DC; 1♀, 17.V.2001, 1♀, 15.V.2011 CM, 2♂♂, 27,31.V.2011 CM;.

Protection measures: endangered species, due to diminishing the preferred areas, forests with high humidity, swamp and wet meadows.

Maculinea arion arion (Linnaeus, 1758), (HD-4, Ber-2, NT, 3^A, CRL, Foto. 5.)



Foto. 5. *Maculinea arion arion*

(<http://www.pyrgus.de/Maculineaarion>)

Biogeographic region: Europe, Germany. **Spreading in**

Romania: Transylvanian Carpathians, North-Moldavia, Banat, North-Oltenia, North-Muntenia. **Habitat type(s):** grasslands,

meadows, bush areas, dry plains, rock slopes. **Status:** localized, rare-common. **Altitude:** 200-1600 m. **Flight period:**

½ V- ½ VII. **Protection status:** VU. **Larval food plants:**

Thymus serpyllum, *T. praecox*. Myrmecophile species.

Overwintering stage: hibernates in larva stage. **Migratory**

status: non migratory. **No. specimens collected:** 3♂♂, 12.VIII.1840 EW.

Literature: Stănoiu&Bobârnac, 1965, Bobârnac&Stănoiu, 1966.

Protection measures: conserving and protecting the preferred habitat, avoiding chemical treatments.

Maculinea nausithous nausithous (Bergstrasser, 1779) (HD-2, HD-4, Ber-2, CR, 3^A, CRL, Foto. 6.)



Foto. 6. *Maculinea nausithous nausithous*

(<https://www.google.ro/search?q=Maculinea+nausithous+nausithous>)

Biogeographic region: Europe, Germany. **Spreading in**

Romania: Transylvania Plain, North-Moldavia, North-Oltenia, South-Bucovina. **Habitat type(s):** wet grasslands with

Sanguisorba, wet meadows. **Status:** very local, common and very-common. **Altitude:** 200-1000 m. **Flight period:** ½ VII-

½ VIII. **Protection status:** CR. **Larval food plants:** *Sanguisorba officinalis*. Myrmecophile species.

Overwintering stage: hibernates in larva stage. **Migratory**

status: non migratory. **No. specimens collected:** 26.V.2001, 22.VII.1922 VW.

Literature: Corduneanu, 1991; Manoliu, 1996; Rákosy&Laszloffy, 1997; Alexinschi&Peiu, 1960, Rákosy&Weber, 1984; Pax, 1906; Rákosy, Goia & Kovacs, 2003; Goia&Dincă, 2006.

Protection measures: preserving and protecting the habitat preferred by the species.

Family ARCTIIDAE

Callimorpha quadripunctaria (Poda, 1761), (HD-2, Foto. 7.)



Foto. 7. *Callimorpha quadripunctaria*

(<https://www.google.ro/search?q=Callimorpha+quadripunctaria>)

Biogeographic region: common species in central Europe, France, Romania. **Habitat type(s):** prefers forest borders, rare forest, meadows, fields and hays. **Status:** localized. **Flight period:** VII- VIII. **Protection status:** VU. **Larval food plants:** *Achillea sp.*, *Plantago sp.*, *Galium sp.*, *Lamium sp.*, *Urtica sp.*, *Epilobium sp.*, *Corylus sp.*, *Lonicera sp.*, *Salix sp.* **Overwintering stage:** hibernates in larva stage. **Migratory status:** non migratory. **No. specimens collected:** 5

ex., 16.V.1939 EW, 10.VI.1945 EW; 13.VI.1938 EW, 27,28.VII.1953 EW; 2.VIII.1888 DC, 1♀, 17.VIII.2001, 1♀, 18.VIII.2003, 1♀, 26.VII.2004, 1♀, 11.VI.2005, 2♂♂, 9,17.VI.2007, 2♀♀, 9.VIII.2011 CM, 2ex., 11.VIII.1904 VW, 15.VIII.1903 VW, 1ex., 17.VIII.1953 EW, 1♂, 17.VIII.2011, 1♀, 18.VIII. 2015 CM.

Protection measures: preserving and protecting the habitat preferred by the species.

Order ORTHOPTERA

Superfamily TETTIGONIOIDEA

Family TETTIGONIIDAE

Subfamily TETTIGONINAE

Pholidoptera transsylvanica, (Fischer, 1853), (3^A, Foto. 8.)



Foto. 8. *Pholidoptera transsylvanica*

(<https://www.google.ro/search?q=Pholidoptera+transsylvanica>)

Biogeographic region: Croatia, Hungary, Slovakia, Romania. **Habitat type(s):** lives in mesofile and higrofile habitats, in subalps meadows, but especially in bushed areas from forest clearings and the edge of it. **Altitude:** Mountain species can reach up to 2200m. At lower altitude is rare. **Food:** is feeded up especially by little orthoptera. **Overwintering stage:** pona is layed in the soil. o depune în sol. Hatching occurs during V-VI. Adults are found in

VII-X. In Romania can be found in all Carpathians (Kis, 1967).

Order COLEOPTERA

Family CERAMBYCIDAE

Subfamily CERAMBYCINAE

Cerambyx cerdo Linnaeus, 1758 (HD-2, HD-4, Ber-2, VU, 3^A, Foto.9.)



Foto. 9. *Cerambyx cerdo*
(<https://www.google.ro/search?q=Cerambyx+cerdo>)

Biogeographic region: Europe (Italy Sicily, France, Greece, Moldova, Spain, Belarus, Ukraine, Crimea, Caucasus, Transcaucasia, Little Asia, Syria, Iran, Turkey North East, North Africa) and in Romania (was reported in the whole country) (Tăușan I., Bucșa C., 2010). **Habitat type(s):** the species is developed from oak, chestnut, beech, walnut, elm, ash. Metamorphosis usually takes three years, sometimes can prolong

up to five. Is found in hardwood forests, especially the oaks and sometimes in parks and gardens. Adults are nocturnal and twilight. During the day they stay hidden in the crown of trees, hollows etc. **Flight period:** V-VIII (Panin&Săvulescu, 1961). The generation lasts 3-4 years. **Protection status:** VU.

Protection measures: preserving and protecting the characteristic habitat, lowering the chemicals treatment in the habitat and forbidding collecting the species.

Rosalia alpina (Linnaeus, 1758), (HD-2, HD-4, Ber-2, VU, 3^A, Foto.10.)



Foto. 10. *Rosalia alpina*
(<https://www.google.ro/search?q=Rosalia+alpina>)

Biogeographic region: Central Europe, Caucasus, Transcaucasia, Crimea, Northeast Turkey, Syria, Israel (Niculiseanu, et al., 1992). **Habitat type (s):** meets the complex beech and conifers, rarely at the oak. By accident may be seen in context of grass and steppes. **Altitude:** up to 1500m. **Flight Period:** adults are active on sunny days and flying the months VII-IX. **Protection status:** VU.

Overwintering stage: metamorphosis takes about 2-3 years. The female lays the eggs or wounds in the bark cracks.

Protective measures: designating areas of conservation, the prohibition of collector collecting the species and preservation of species characteristic biotope.

Subfamily LAMIINAE

Morimus funereus Mulsant, 1863, (Hd-2, VU, 3^A, Foto.11.)



Foto. 11. *Morimus funereus*
(foto. orig.)

Biogeographic region: Spain, France, Italy, southern Austria, Croatia, Bulgaria, Moldova, the Balkan Peninsula, Ukraine and Romania present throughout the country (Niculiseanu, et al., 1991).

Habitat type (s) : can be found in deciduous especially those of oaks and beech, but also in coniferous woods

(Panin & Săvulescu, 1961). The larva develops in oak tree trunks (Ene, 1971).

Flight period: V-VII.

Protective measures: the protection of the elderly from the deciduous trees, the prohibition of the collectors collecting amatory species, reduce chemical treatments in forest ecosystems, preserving and protecting the characteristic biotope.

Family LUCANIDAE

Subfamily LUCANINAE

Lucanus cervus Linnaeus, 1758 (HD-2, Ber-2, LR, 3^A, Foto.12.)



Foto. 12. *Lucanus cervus*
(<https://www.google.ro/search?q=Lucanus+cervus>)

Biogeographic region: Europe, Central Asia, the Crimea, the Caucasus, North Africa (Niculiseanu, et al., 1992). **Habitat type (s):** *Sapro-xylophagous* species present in the old oak forest. The caterpillar type melolontiform develops in rotten wood of deciduous trees from different families: Betulaceae (*Alnus spp.*, *Carpinus spp.*), Fagaceae (*Quercus spp.*, *Fagus spp.*), Hippocastanaceae (*Aesculus spp.*), Juglanceae (*Juglans spp.*), Moraceae (*Morus spp.*), Oleaceae (*Acer spp.*), trees of the family Rosaceae (*Pyrus spp.*, *Malus spp.*, *Cerasus spp.*, *Prunus spp.*) and even pine wood, family Pinaceae (*Picea spp.*, *Pinus spp.*) (Maes, 2005). **Larva:** larva development lasts 4-5 years and is influenced by temperature, humidity, food.

Flight period: Adults appear in VI-VII. Beetles are nocturnal and crepuscular, sitting on branches or tree trunk, rarely flies by day. Adults sucking the water running from tree wounds. It is found in old deciduous forests, woods, quercus, preferring particularly in the areas of steppe grasslands, parks and gardens.

Protective measures: the protection of the elderly from deciduous trees, preserving and protecting the characteristic habitats, prohibiting the collection species.

Family SCARABAEIDAE

Subfamily TRICHIINAE Kolbe, 1879



Foto. 13. *Osmoderma eremita*
(<https://www.google.ro/search?q=Osmoderma+eremita>)

Osmoderma eremita (Scopoli, 1763), (HD-2, HD-4, Ber-2, VU, 3^A, Foto.13.)

Biogeographic region: Europe, except the northern part, Belarus, Moldova, European Russia (north to St. Petersburg and the south to the southern border area ante steppes), Ukraine, North Caucasus (Niculiseanu, et al., 1991). **Habitat type (s):**

very rare species of fauna coleopterans where the country meets the ante steppe to the phage (Panin, 1961). The larva lives in the hollows of the trunk rotten wood of deciduous species: apple, pear, oak.

Metamorphosis usually takes three years. Adults fermented feed discharge shafts. They are active during the months VI-IX, as can be seen flying or placed on the trunks of trees or leaking sap. It is found in the old hardwood forests, gardens and parks with hollow old trees. **Protective measures:** prohibiting the collection of species, protecting the biotope preferred.

CONCLUSIONS

They were identified 12 community interest species of protected insects, attesting diversity entomofauna area and the need to protect them for preservation.

According to IUCN, *Maculinea mausithous nausithous* species is critically endangered taxon (Near threatened), and a species that belongs to the category of low risk taxon (Lower Risk), lepidopters *Parnassius apollo jaraensis* Kertész, 1922; *Parnassius apollo transsylvanicu* Schweitzer, 1912; *Parnassius mnemosyne transsylvanica* Schmidt, 1930 (Papilionidae) (Török & Cuzepan, 2012; Cupezan, et al., 2015).

We believe that the identification of protected species of Community interest insects which joins the protected species of Community interest identified from other classes of invertebrates and vertebrates, justify the initiatives of the study needed to "Dumbrava Sibiu" Forest.

Entomofauna of "Dumbrava Sibiului" Forest is very little studied and known, therefore, is suggested to carry out systematic studies to know the diversity of this group of invertebrates.

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