



N°14, December 2019

# NEWSLETTER



## EUROCAROTEN

EUROPEAN NETWORK TO ADVANCE CAROTENOID RESEARCH  
AND APPLICATIONS IN AGRO-FOOD AND HEALTH

### WELCOME

**We are pleased to welcome you to the 14<sup>th</sup> issue of the EUROCAROTEN newsletter.**

In this issue read about EUROCAROTEN's International Conference on Carotenoid Research and Applications in Agro-food and Health and final meetings of the Action, held in November 2019 in Lemesos, Cyprus.

Have a look on the "News from the Action" rubric to find finished STSMs during the last period and read "STSM experience report" by Marina Christofi and Alena Stupar.

Read about our carotenoid of the month – antheraxanthin and about the use of lactic fermentation in production of products rich in carotenoids.

In "Think Tank Information" rubric, check some of researches by ECIs presented at International Conference on Carotenoid Research and Applications in Agro-food while in "Working Group News" rubric, find out summarized progress report of WG1, Production: developing resources and biosynthetic pathways, given by Prof. Gehard Sandmann.

Also, you can find more information about EUROCAROTEN COST Action on its COST website [http://www.cost.eu/COST\\_Actions/ca/CA15136](http://www.cost.eu/COST_Actions/ca/CA15136) and on our website [www.eurocaroten.eu](http://www.eurocaroten.eu).

*Yours sincerely,  
Anisa Peçuli,  
Ng'andwe Kalungwana,  
Kristina Kljak*



Subscription to the e-mailing list is  
available via the EUROCAROTEN  
website.

Send your comments and proposals to  
[info@eurocaroten.eu](mailto:info@eurocaroten.eu).

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### NEWS FROM THE ACTION

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Conference on Carotenoid Research and  
Applications in Agro-food and Health  
November 2019, Lemesos, Cyprus

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"I consider important that research proposals for  
different European funding instruments should be  
drafted and submitted after the end of the  
EUROCAROTEN action in order to keep the  
momentum live and active."

### CAROTENOIDS IN DAILY LIFE

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Carotenoid of the Month: Antheraxanthin

"Antheraxanthin is a bright yellow, xanthophyll cycle  
pigment found in many organisms that perform  
photosynthesis, eukaryotes, plants, and some  
bacteria."

Lactic fermentation in products rich in carotenoids

"Lactic fermentation is a specific type of fermentation  
that uses lactic-acid-producing bacteria to preserve  
foods"

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ECIs at the Conference on Carotenoid Research and  
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Progress of WG1



# NEWS FROM THE ACTION

## PAST EVENTS

### International Conference on Carotenoid Research and Applications in Agro-food and Health

### The final meeting of COST Action EUROCAROTEN

26<sup>th</sup> – 28<sup>th</sup> November 2019



#### Organisation

- Cyprus University of Technology, Department of Agricultural Sciences, Biotechnology, Food Science, Cyprus
- Agricultural University of Athens, Greece
- EUROCAROTEN

Venue: Royal Apollonia Hotel, Lemesos, Cyprus

International Conference on Carotenoid Research and Applications in Agro-food and Health was open by **inaugural pre-Conference talk by A. Mavromoustakos** “How to educate and train yourself on using data to problem solve in the Era of Analytics” on 25<sup>th</sup> of November 2019. Official program of conference started on 26<sup>th</sup> November after opening remarks by one of convenors, **George Manganaris**, and from the Chair of EUROCAROTEN Action, **Antonio J. Meléndez-Martínez**. Participants were also greeted by **Prof. Andreas Anayiotos**, Rector of Cyprus University of Technology. **In total, more than 100 delegates from 35 different countries participated at the Conference.**

In total, **seven plenary talks and 56 oral/flash oral presentations** were given at the Conference which was organised in seven sessions covering Production & Development, Quality & Food Chain, and Nutrition & Health. Plenary talks were given by **Paul Christou** (University of Lleida-Agrotecnio, Spain), **Nora M. O'Brien** (Cork University, Ireland), **Torsten Bohn** (Luxembourg Institute of Health, Luxembourg), **Giovanni Giuliano** (Italian National Agency for New Technologies, Energy and

Sustainable Development, Italy), **Andreu Palou** (Universidad de les Illes Balears, Spain), **Elisabeth J. Johnson** (Tufts University, USA) and **Antonio J. Meléndez-Martínez** (Universidad de Sevilla, Spain).

Conference was accompanied by attractive social program which included gala dinner at Lemesos marina, visits to Curium palace, mosaics and Old Harbour at Pafos, and visits to church and wine tasting at Omodos village.

Conference scientific program was accompanied by **meetings within EUROCAROTEN**. On 26<sup>th</sup> November, WG1, 2 and 3 parallel meetings were held; participants discussed and arranged planned deliverables which were, together with progress report within WG4, presented to all participants on 27<sup>th</sup> November. Please read more about progress in WGs in “WG news” rubric in this and future issues of the Newsletter.

The **Management Committee meeting** was held on 28<sup>th</sup> November, after finished scientific program of Conference, Chair of Action, Antonio J. Meléndez-Martínez, presented the overall report of the Action and presented **possibility to apply for COST Innovative Grant in January 2020**. Possible ideas and future collaborations were discussed. Furthermore, the third training school within **EUROCAROTEN** “**Training school on animal models, cell cultures and nutrigenomics**” was announced to take place in **February 2020** at Universidad de les Illes Balears, Spain, organized by Joan Ribout and Jaap Keijer.

To see photos from the meeting please visit our Facebook page: [www.facebook.com/eurocaroten](https://www.facebook.com/eurocaroten)



# NEWS FROM THE ACTION

## FINISHED STSMs

### SAVE THE DATE

## Training school about cell cultures

UIB, Mallorca, Balearic Islands, Spain

10<sup>th</sup> – 14<sup>th</sup> February 2020



#### CHARACTERIZATION OF SEaweEDS AND MICROALGAE AS SOURCE OF CAROTENOIDS AND THE POSSIBILITY OF ITS APPLICATION IN MEAT PRODUCTS

**Grant Holder**

Igor Tomašević, University of Belgrade, Serbia

**Period**

10<sup>th</sup> June – 12<sup>th</sup> August 2019

**Host Institution**

University of Valencia, Spain

#### ASSESSING THE PHENOLIC AND CAROTENOID CONTENT OF EIGHT CLINGSTONE PEACH CULTIVARS AT HARVEST AND AFTER PROCESSING

**Grant Holder**

Marina Christofi, Cyprus University of Technology, Cyprus

**Period**

15<sup>th</sup> September – 11<sup>th</sup> October 2019

**Host Institution**

Institute of Biology, Medicinal Chemistry and Biotechnology, National Hellenic Research Foundation, Greece

#### BASICS ON THE SYNTHESIS OF CAROTENOIDS

**Grant Holder**

Dr Antonio J. Melendez-Martinez, Universidad de Sevilla, Spain

**Period**

9<sup>th</sup> – 14<sup>th</sup> September 2019

**Host Institution**

Norwegian University of Science and Technology, Norway

#### PASTA ENRICHED WITH ENCAPSULATED CAROTENOIDS

**Grant Holder**

Vanja Šeregelj, University of Novi Sad, Serbia

**Period**

15<sup>th</sup> September – 15<sup>th</sup> October 2019

**Host Institution**

Università degli Studi di Milano, Italy

#### EXTRACTION OF CAROTENOIDS USING TASK SPECIFIC NADES

**Grant Holder**

Alena Stupar, University of Novi Sad, Serbia

**Period**

4<sup>th</sup> September – 3<sup>rd</sup> November 2019

**Host Institution**

Universidade de Lisboa, Portugal

# NEWS FROM THE ACTION

## CONTRIBUTION FROM THE ACTION & FINISHED STSMs



### EUROCAROTEN MEMBER PROF JOHN NOLAN HONOURED AT IRISH AMERICA AWARDS IN NEW YORK

Professor John Nolan (Waterford Institute of Technology, Ireland) was named among the 2019 Healthcare & Life Sciences 50 announced by Irish America magazine at the Metropolitan Club in Manhattan. The list celebrates excellence by Irish and Irish-American leaders in fields such as medical care; pharmaceuticals; biotechnology; medical devices; research and development and life sciences venture capital.

Read more at

[https://www.wit.ie/news/all\\_news/wit\\_professor\\_honoured\\_at\\_irish\\_america\\_awards\\_in\\_new\\_york](https://www.wit.ie/news/all_news/wit_professor_honoured_at_irish_america_awards_in_new_york).

### PUBLICATION BY EUROCAROTEN MEMBERS

#### Publication in BMC Plant Biology

EUROCAROTEN members María J. Rodrigo, Joseph Hirschberg & Lorenzo Zacarías are co-authors of article “A mutant allele of  $\zeta$ -carotene isomerase (Z-ISO) is associated with the yellow pigmentation of the “Pinalate” sweet orange mutant and reveals new insights into its role in fruit carotenogenesis” published in BMC Plant Biology. Article is available using the following link:  
<https://bmcpplantbiol.biomedcentral.com/articles/10.1186/s12870-019-2078-2>.

#### Publication in bioRxiv journal

An article by EUROCAROTEN scientists reports how plant chloroplasts can be transformed into chromoplasts to provide extra carotenoids and new colors to leaves. For more information, use following link:  
<https://www.biorxiv.org/content/10.1101/819177v1>.

### SPECIAL ISSUE OF NUTRIENTS

EUROCAROTEN member Dr. Begoña Olmedilla-Alonso (CSIC - Instituto de Ciencia y Tecnología de Alimentos y Nutrición (ICTAN), Spain) will be guest editor, together with Dr. Elena Rodríguez Rodríguez (Complutense University of Madrid,

Spain) of special issue of Nutrients - Vitamin A: Dietary Intake and Bioavailability of Provitamin A Carotenoids and Retinol in Human Health. Deadline for article submission is 29<sup>th</sup> February 2020.

### SPECIAL ISSUE OF ANTIOXIDANTS

EUROCAROTEN member Dr. Torsten Bohn (Luxembourg Institute of Health, Department of Population Health, Luxembourg) will be guest editor of special issue of Antioxidants - Carotenoids, Oxidative Stress and Disease. Deadline for article submission is 30<sup>th</sup> April 2020.

### SPECIAL ISSUE OF INTERNATIONAL JOURNAL OF MOLECULAR SCIENCES “METABOLIC ENGINEERING OF PLANTS”

EUROCAROTEN members Dr. Maria Lourdes Gómez-Gómez (Universidad de Castilla-La Mancha, Spain) and Dr. Gianfranco Diretto (ENEA, Italy) will be guest editor of special issue of International Journal of Molecular Sciences “Metabolic Engineering of Plants”. Deadline for article submission is 30<sup>th</sup> June 2020. For more information, see  
[https://www.mdpi.com/journal/ijms/special\\_issues/plant\\_metabolic](https://www.mdpi.com/journal/ijms/special_issues/plant_metabolic).

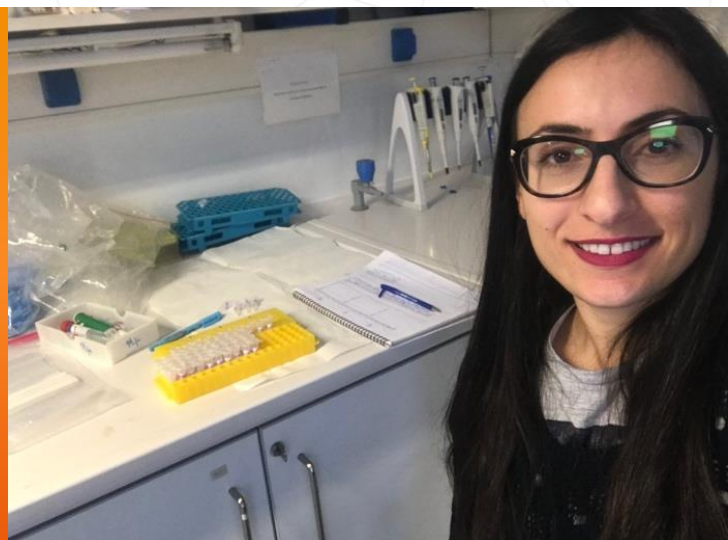


# FINISHED STSM'S EXPERIENCE REPORT

Marina Christofi

## ASSESSING THE PHENOLIC AND CAROTENOID CONTENT OF EIGHT CLINGSTONE PEACH CULTIVARS AT HARVEST AND AFTER PROCESSING

Affiliation	Cyprus University of Technology, Department of Agricultural Sciences, Biotechnology and Food Sciences, Limassol, Cyprus
Position	PhD student
Host Institution	National Hellenic Research Foundation, Athens, Greece
E-mail	<a href="mailto:man.christofi@edu.cut.ac.cy">man.christofi@edu.cut.ac.cy</a>



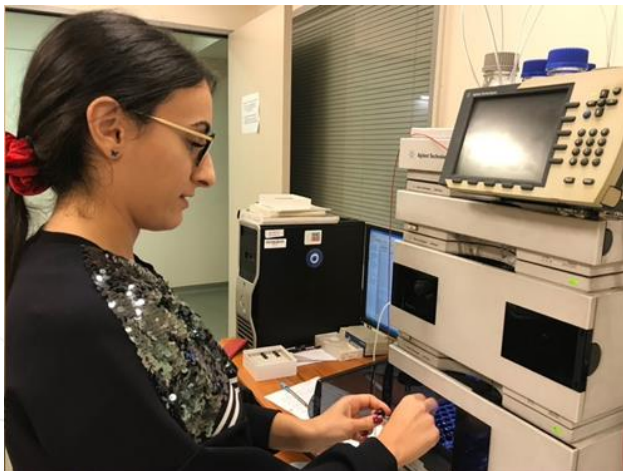
My short-term scientific mission was carried out at the premises of **National Hellenic Research Foundation in Institute of Biology, Medicinal Chemistry and Biotechnology in Athens** for four weeks, under the scientific supervision of **Dr. Panagiotis Zoumpoulakis**. The main purpose of this STSM was to render myself familiar with state-of-the-art analytical technique such as liquid chromatography mass spectrometry related to the **phytochemical profile analysis of fleshy peach fruits**. The objectives were to assess the bioactive profile of eight commercially important clingstone peach cultivars both at harvest (fresh) and after processing (canned); aiming at the **evaluation of the impact level of processing on the composition of bioactive compounds in peach fruit, with special reference to carotenoid content**.

From a scientific point of view, this short visit was a very enriching experience. I had the opportunity to **learn new techniques and used new equipment** not available in my Home Institution. I broadened my knowledge with the basic principle of **chromatography analysis and applications for the identification and quantification of specific carotenoid compounds**. Additionally, I met new people sharing common research facilities and established relevant scientific discussions with other laboratory members. Working with such experienced and skilled Host group was enjoyable for me as I had the chance to **significantly improved my theoretical and practical skills by learning new analytical methods**.

From recreational point of view, I enjoyed **exploring the city centre and the surrounding places of Athens**.

Enhanced my experience staying in Athens by visiting tour on mythological and ancient Greek city, alongside with major landmarks like the Acropolis and the Olympian Zeus Temple. Besides that, I loved tasting the Greek specialties including souvlaki, gyros, koulúria (sesame bread rings) and loukoumades (Greek donuts).

At this point, I would like to take the opportunity to **thank all the contributors** individually for the support they gave me to accomplish this significant and great part of my research work. **Special thanks to EUROCARTEN committee for their financial support, my academic supervisor Dr George Manganaris, Dr Panagiotis Zoumpoulakis including all the members of his research group and Venus Growers- industrial partner.**



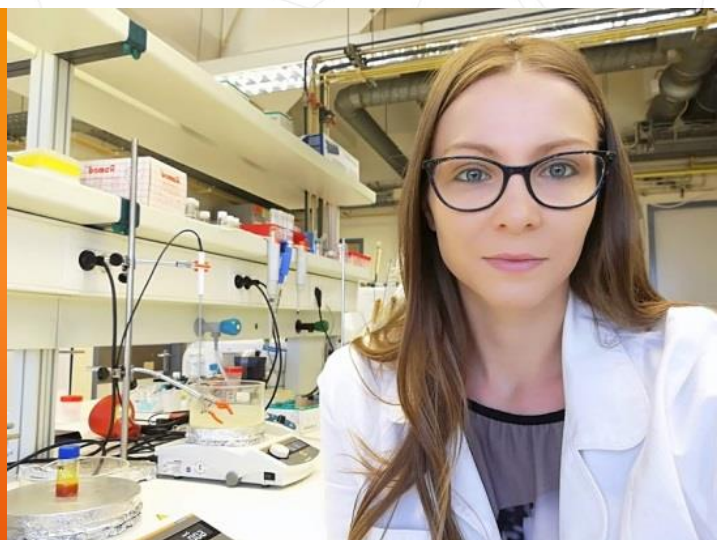


# FINISHED STSM'S EXPERIENCE REPORT

Alena Stupar

## EXTRACTION OF CAROTENOIDS USING TASK SPECIFIC NADES

Affiliation	University of Novi Sad, Novi Sad, Serbia
Position	PhD student
Host Institution	Universidade de Lisboa, Portugal
E-mail	<a href="mailto:alena.tomsik@fins.uns.ac.rs">alena.tomsik@fins.uns.ac.rs</a>



Thanks to the Cost Action CA15136 I was able to spend 2 months at **Instituto Superior Técnico in Lisbon**, which showed to be a great way to start new scientific collaboration and offered opportunities to gain scientific and technical knowledge from the experts from the host institutions.

The main aim of this research and STSM was based on **the new generation of green solvents which can be used as a substitute for toxic organic solvents for the extraction of carotenoids**. During the STSM, different **hydrophobic natural deep eutectic solvents (NADES)** with good extraction capacity for  $\beta$ -carotene were characterized. After the selection of favorable solvent, further research was focused on optimization of extraction parameters in order to maximize the **extraction yield of  $\beta$ -carotene from pumpkin**. Thanks to the opportunity of STSM and conducted research we have obtained good **results** which will be **published in scientific papers and presented at scientific conference**, while the **gained knowledge and practical work will enhance research capacities of the home institution**.

I would like to thank **Prof. Isabel Marrucho** for her willingness to receive me, pleasant stay and shared knowledge. I believe this STSM was the first step to achieve set joint research goals and strong

collaboration that would open new possibilities of these two complementary teams to cooperate and exchange their knowledge.

Apart from research and knowledge upgrade, STSMs represent **a great opportunity also for personal development**. I highly recommend young researchers to undertake short research stays abroad to **improve their experience and broaden scientific horizons**.



# EUROCAROTEN INTERVIEW

## TALKING WITH:

### George Manganaris

Affiliation	Cyprus University of Technology
Position	Associate Professor
Country	Cyprus
Area of Interest	horticulture, arboriculture, fruit quality, postharvest physiology and technology, phytochemical analysis )



#### **Please tell us a bit about your lab and what you work on?**

We are part of the **Department of Agricultural Sciences, Biotechnology and Food Science (ABF) at the Cyprus University of Technology (CUT)**, based in Lemesos, Cyprus. The Fruit Sciences/Postharvest Group was established upon my recruitment at CUT in January 2009. The Group is currently composed by one post-doctoral researcher, two PhD students, two MSc students and a number of undergraduate students. Our group is having **extensive research experience in issues related to preharvest and postharvest factors affecting fresh produce with special reference to fruit crops and grapes**. We can routinely run an array of assays related to qualitative, physicochemical, phytochemical and biochemical properties of fresh produce.

#### **In general terms, which area of the carotenoids do you find most interesting?**

I am particularly interested in **carotenoids that can be found in fruit commodities**. A past work jointly with CEBAS-CSIC dealt with the metabolic and transcriptional elucidation of the carotenoid biosynthesis pathway in peel and flesh tissue of loquat fruit during on-tree development (BMC Plant Biology 2017, 17:102). **Key results indicated differential regulation of expression levels with the progress of on-tree fruit development that was more evident in the middle and downstream genes of carotenoid biosynthetic pathway**. Currently, under a scheme of a PhD project, we are determining the predominant carotenoids found in peach fruit, both flesh and canned (processed). Through this approach, we want to dissect the processing

effect on carotenoid content as well as to monitor genotype differences.

#### **In your eyes, how can the EUROCAROTEN COST Action contribute to carotenoid research?**

I consider important that **research proposals for different European funding instruments** should be drafted and submitted after the end of the **EUROCAROTEN action in order to keep the momentum live and active**.

#### **You are organizer of “International Conference on Carotenoid research and applications in agro-food and health” – please tell us your experience in organization and how this conference will contribute to carotenoid researchers?**

I am really honoured and glad hosting the final EUROCAROTEN meeting.

The Conference is a joint initiative of the Cyprus University of Technology, Department of Agricultural Sciences, Biotechnology & Food Science and the Agricultural University of Athens, Greece. **Professor Serkos Haroutounian is acting as co-convenor and I take the opportunity to thank him for his impact in the development of the scientific part of the conference**.

Notably, we have secured attendance by more than 40 delegates besides the 80 officially invited COST invitees. Such numbers **indicate the great interest for the carotenoid research as a whole**. I consider very important that we have attracted **world-renowned keynote speakers** who at the same time are expected to become **familiar with the principles of our COST Action**.



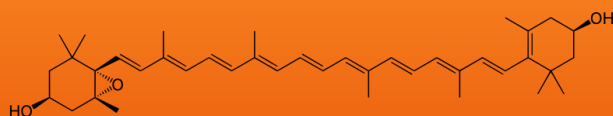
# CAROTENOIDS IN OUR DAILY LIFE

## CAROTENOID OF THE MONTH

Name: Antheraxanthin

Chemical Formula:  $C_{40}H_{56}O_3$

Molecular Weight: 584.9 g/mol



### ANTHERAXANTHIN

Antheraxanthin is both a product and component in the cellular mechanism of photosynthesis in green and red algae, euglenoids and plants. Its name comes from Greek, meaning the yellow flower, from anthon referring to flower and xanthos to the color “yellow”.

Antheraxanthin is a bright yellow, xanthophyll cycle pigment found in many organisms that perform photosynthesis, eukaryotes, plants, and some bacteria. Through the xanthophyll cycle, specific carotenoid pigments are transformed via enzymatic reactions into photoprotective biological pigments, specifically converting the orange pigment violaxanthin to antheraxanthin and then to light-yellow pigment zeaxanthin. Violaxanthin de-epoxidase is an enzyme that reduces one epoxide group from violaxanthin into a double bond to create antheraxanthin and zeaxanthin epoxidase catalyses the attachment of one epoxide group to zeaxanthin to generate antheraxanthin.

This bright yellow pigment has been found in high levels in sun-exposed dandelions (*Taraxacum officinale*), located in the membrane of thylakoids in chloroplasts, providing more heat and light stability to the cells.

### LACTIC FERMENTATION IN PRODUCTS RICH IN CAROTENOIDS

Fermentation is one of the oldest methods of food processing. Lactic fermentation is a specific type of fermentation that uses lactic-acid-producing bacteria to preserve foods. But what is lactic fermentation? Is a metabolic process by which six-carbon sugars are converted into cellular energy and the metabolite lactate which is a solution of lactic acid. The process results in a fermented food product with a desirable flavour, aroma, or texture and several health benefits of eating lacto-fermented foods.

Foods fermented with lactic acid play an important role in feeding the world's population on every continent, especially filling dietary gaps or in countries with malnutrition and undernutrition problems.

Different technologies are being used to help with this deficiency. Researchers have worked on the impact of steaming, drying and lactic acid fermentation on trans-β-carotene in sweet potato. It is reported a less than significant change in β-carotene in the varieties processed by fermentation. Lacto-products produced by lactic acid fermentation are known to have nutraceutical attributes.

Texts by Vilma Gurazi, PhD at Agriculture University  
of Tirana, Albania

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# THINK TANK INFORMATION

## ECIs AT CONFERENCE

### International Conference on Carotenoid Research and Applications in Agro-food and Health

26<sup>th</sup> – 28<sup>th</sup> November 2019

Lemesos, Cyprus



#### PREPARATION AND CHARACTERIZATION OF NOVEL B-CAROTENE LOADED NANOPARTICLES

**A. Bockuviene, E. Rodríguez, J. Sereikaite, B. Olmedilla-Alonso**

In this study, we report a successful synthesis of two component  $\beta$ -carotene-chitoooligosaccharides (IIC-CHIOS- $\beta$ CAR) nanoparticles by mechanochemical complexation method and three-component  $\beta$ -carotene-chitoooligosaccharides-poly- $\gamma$ -glutamic acid (IIIC- $\beta$ CAR-CHIOS- $\gamma$ PGA) nanoparticles by encapsulation method. The complexation of  $\beta$ CAR with CHIOS and additional coating of nanoparticles with  $\gamma$ PGA improve physicochemical properties and strongly increase  $\beta$ -carotene stability towards light irradiation and temperature conditions. Novel nanoparticles could serve for  $\beta$ -carotene delivery and food fortification.

#### FRACTIONATE ANALYSIS OF LYCOPENE METABOLISM GENE EXPRESSION LEVELS AND LYCOPENE CONTENT IN FIVE TOMATO CULTIVARS DURING RIPENING

**E. C. Georgiadou, C. Antoniou, V. Goulas, P. Filippou, P. Challouma, M. Keveze, B. Smolińska, J. Leszczyńska, V. Fotopoulos**

The present work studies the gene expression pattern of lycopene biosynthesis/catabolism transcripts and accumulation pattern of lycopene at three different tissues of tomato fruit (skin, flesh and seeds) during three developmental stages (green, breaker, ripe) in five

tomato cultivars (cvs. 'Cherry Ninolino F1', 'Elpida F1', 'Daphne F1', 'Eliseo Plum F1' and 'Oxheart') commonly consumed in Cyprus. Higher levels of lycopene were observed at the ripe stage in the skin than in the other tissues, with 'Oxheart' displaying the highest content and correlating with significant induction of both lycopene biosynthetic genes (SIZDS and SICRTISO). Antioxidant activity decreases as we go further inside the fruit because the skin absorbs light in an attempt to lower oxidative stress damage from sun irradiation. Consumption of ripe tomatoes including the skin could be useful for the protection of human health.

#### INFLUENCE OF DIETARY PROTEINS ON THE BIOACCESSIBILITY OF SELECTED FOOD MATRICES

**M. Iddir, G. Dingeo, E. Cocco, C. Desmarchelier, T. Schlee, C. Guignard, P. Borel, Y. Larondelle, T. Bohn**

In this study, we investigate the influence of a commonly consumed protein sources, on the bioaccessibility of carotenoids from selected rich-food matrices. This study could give indications for a diet allowing better absorption of carotenoids. This would be particularly beneficial for people who do not consume enough vitamin A from meat, such as vegetarians and vegans, but also people living in less industrialized countries where meat consumption is relatively limited, or subjects with gastrointestinal disorders limiting the metabolism of carotenoids.

# THINK TANK INFORMATION

## ECIs AT CONFERENCE ON CAROTENOID RESEARCH AND APPLICATIONS IN AGRO-FOOD AND HEALTH

### UTILIZATION OF VACUUM DRYING IN RETENTION OF $\beta$ -CAROTENE CONTENT IN WINTER SQUASH (*CUCURBITA MOSCHATA*)

**M. Marelja, K. Kljak, M. Brnčić, F. Dujmić, S. Rimac Brnčić, J. Šic Žlabur**

Vacuum drying allows water evaporation at lower temperatures since it implies low pressures and thus allowing preservation of heat-sensitive bioactive compounds such as carotenoids. Squashes and pumpkins are a rich source of different carotenoids, mostly  $\beta$ -carotene. In vacuum drying, a proper combination of pressure and temperature provide an effective way for the retention of  $\beta$ -carotene in the final product. Content of  $\beta$ -carotene, together with the sensory characteristic (colour), are well preserved by vacuum drying.

### WHOLE PLANT $^{13}\text{CO}_2$ -LABELLING FOR CAROTENOID TURNOVER ANALYSIS IN LEAVES

**T.M.A. Banh, B. Thiele, A. Chlubek, T. Hombach, E. Kleist, S. Matsubara**

To obtain quantitative information on leaf carotenoid turnover in intact plants, we constructed a  $^{13}\text{CO}_2$  labelling chamber in which up to 15 small plants, such as *Arabidopsis thaliana*, can be grown over days. After testing the environmental control of the chamber by continuously monitoring the conditions inside under  $^{12}\text{CO}_2$ , a protocol was established to perform long-term  $^{13}\text{CO}_2$  labelling experiments with *Arabidopsis* plants. The results

from the first experiment show that this system, when combined with metabolic profiling, can be used for pulse-chase labelling experiments to study the turnover rate of carotenoids and other plant metabolites.

### THE BIOREACTOR SYSTEM FOR THE ASTAXANTHIN PRODUCING MICROALGAE *HAEMATOCOCCUS PLUVIALIS*: CONSTRUCTION, QUANTIFICATION AND DETERMINATION OF THE ASTAXANTHIN

**V. J. Grujić, Z. Molnar, T. Todorović, J. Ambrožič-Dolinšek**

At a scientific symposium in Lemesos, as a member of the research group at the Department of Biology, Faculty of Natural Sciences and Mathematics, Slovenia, I presented our work so far in establishing the efficient and flexible bioreactor system for the cultivation of algae *Haematococcus pluvialis* with ability of fast and accurate change of growth conditions. We determined the yield of algal biomass and astaxanthin content of five different strains of *H. pluvialis* and optimized the growth conditions during two growth phases of *H. pluvialis*. Currently we are testing different cell disruption methods, stabilization and extraction methods and trying to evaluate the diversity and content of the carotenoid compounds in alga *H. pluvialis* using Q-TOF Mass Spectrometer analysis.



OF EARLY CAREER INVESTIGATORS AND  
OTHER YOUNG RESEARCHERS

Representatives for 4<sup>th</sup> grant period:

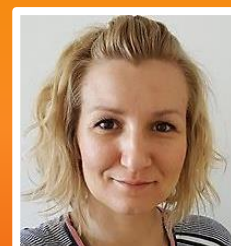
ECI spokesperson:



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Ng'andwe Kalungwana  
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Kristina Kljak  
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# WORKING GROUP NEWS

Discussion leader of WG1 PRODUCTION: DEVELOPING RESOURCES AND BIOSYNTHETIC PATHWAYS, Gerhard Sandmann summarized the WG achievements so far

Our efforts are **mainly focussed on the evaluation of the state of the art in carotenoid biosynthesis and in pathway products including the definition of critical topics and future directions**. For efficient knowledge transfer, we encouraged young career scientists to participate in STSMs with other EUROCAROTEN laboratories from which several publications resulted.

As described as **Task 1 – Identification of sources/technologies for obtaining carotenoids of interest**, carotenoids of interest were defined and listed. The importance of different individual carotenoids were highlighted in the EUROCAROTEN Newsletter, for example in “Carotenoid of the Month”. Practical outcomes were the database “Carotenoid composition of microorganisms” and a second database “Carotenoid composition of fruits and flowers”.

According to **Task 2 - Generation of maps of biosynthetic pathways**, several WG1 members contributed to a review: “A global perspective on carotenoids:

Metabolism, biotechnology, and benefits for nutrition and health” (Prog Lipid Res 70:62 (2018)).

As part of **Task 3 - Sustainable production of carotenoids**, a one-day workshop with the same title was held at our meeting at Trogir, Croatia, which included key lectures by invited speakers from academia and industry for scientific exchange between them and definition of common interest, contributed lectures by early career investigators to initiate their interactions with distinguished scientists.

**Task 4 - Harmonisation of key protocols** – led us to develop standard protocols for carotenoid analysis. In addition, we held a training school for young researchers with introductory lectures and a lab course to practice analysis of different carotenoids from different tissue. A special dissemination effort was to teach younger and advanced school children the importance of carotenoids in our life.

## ACKNOWLEDGEMENTS

**We would like to thank everyone who has so kindly contributed with the content present in this newsletter:**

**Antonio J. Meléndez Martínez and Cristina L.M. Silva** for their guidance and supervision during the making of the EUROCAROTEN Newsletter.

**Marina Christofi and Alena Stupar** who have kindly given their testimony.

**George Manganaris** for her contribution to our EUROCAROTEN Interview.

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