CITAB | NEWSLETTER

Centre for the Research and Technology of Agro-Environment and Biological Sciences

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Editors: José Lousada, Alfredo Aires, Ana Coimbra, Tânia Martins and Lígia Pinto

Editorial and Highlights

As the new Director of CITAB is my pleasure to introduce the 10th issue of our newsletter, where CITAB 2018 most relevant achievements are highlighted using a fresh new layout image. At the end of this year, CITAB embraced 285 researchers, devoted to promote and develop innovative solutions in the areas of Agri-food, Forestry and Environment, and to build on new and relevant national and international partnerships. An example of this effort is the coordination of the Twinning project "Clim4Vitis – Climate change impact mitigation for European viticulture: knowledge transfer for an integrated approach", funded with 1 million euro.

Our efforts to strength our relations with science partners and stakeholders result on CITAB participation in three Collaborative Laboratories (CoLabs), on the establishment of collaboration protocols with two R&D national units and on fifteen Operational Groups projects, among others. On 2018, CITAB research was undoubtedly transposed from the lab to the market. Three spin-offs were created and national reference wine producers are applying climate change mitigation strategies based on results from our studies. This edition "Hot topic", on technologies development for mitigation of greenhouse gases, stresses further our results application.

CITAB researchers spread the seeds of science and technology on general public audiences, particularly among our youth (3-17 years old), by continue to promote several outreach activities.

This newsletter issue shows how CITAB grew in the past years and how new doors are open to the future!

Ana Barros, CITAB's Director

CITAB coordinates H2020 Twinning Project: Clim4Vitis

Starting in September 2018, *"Clim4Vitis - Climate change impact mitigation for European viticulture: knowledge transfer for an integrated approach"* is a Coordination and Support Action project, funded with 1 million euro by the EU Horizon 2020, under the Twinning instrument and coordinated by CITAB's researcher João Santos. The prime objectives of "Clim4Vitis" are to strengthen and raise CITAB's science & technology capacity and performance in grapevine modelling and in tools for assessing climate change impacts on viticulture. The project consortium comprises the following institutions: UTAD – as Coordinator Institution; Potsdam Institut fuer Klimafolgenforschung (PIK); Università degli Studi di Firenze (UNIFI); Luxembourg Institute of Science and Technology (LIST); and Sociedade Portuguesa de Inovação (SPI). "Clim4Vitis" will have its Launch Event at UTAD from 18th to 20th February 2019, on which renowned scientists and wine producers will be invited speakers. Parallel capacity building actions (workshops and short courses) will also be organized.

Clim4vitis

Climate change impact mitigation for European viticulture

CLIM4VITIS DAYS

18-20 February 2019

UTAD, Vila Real

CLIM4VITIS INTRODUCTION

Clim4Vitis is a Coordination and Support Action (CSA) project, funded by the European Commission under the Twinning instrument of the Horizon 2020 Programme. The project aims to promote knowledge transfer and science and technology (S&T) capacity building in viticulture & climate. Clim4Vitis will devise new methods and tools for modelling grapevines, and for assessing climate change impacts on European viticulture. It will lead to increases in UTAD's capability to address such aspects.

GRAPEVINE MODELLING WORKSHOP

CLIM4VITIS CONFERENCE

CLIMATE CHANGE VITICULTURE COURSE

JOIN US!

REGISTER NOW FOR FREE

www.clim4vitis.eu/event/clim4vitisweek/

More info:

www.clim4vitis.eu

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João Santos | jsantos@utad.pt

GRAPEVINE MODELLING WORKSHOP

This workshop will provide an overview of different state-of-the-art approaches for modelling grapevines. It will be held in four modules, organized by three leading institutions, and will provide insights on elements such as grapevine phenology, growth, yields or pests and diseases under different environmental conditions. A final discussion panel will enable an active participation of all attendees.

Target audience: UTAD's researchers, researchers from partner institutions, relevant individuals from partner universities, winemaking companies and associations.

CLIM4VITIS CONFERENCE

An official launch conference will be organised to disseminate useful insights on the objectives of the project and the impacts foreseen. Distinguished speakers will present their viewpoints on climate change and its potential impacts on European viticulture. This event will be a platform for stakeholders to connect with the project and amongst themselves with a common objective of promoting knowledge transfer and S&T capacity building.

Target audience: Winemaking companies, clusters and associations, viticulture research academia, municipalities, and media groups.

CLIMATE CHANGE VITICULTURE COURSE

This course will be devoted to climate change and European viticulture. It will provide insights on the state-of-the-art and best practices with added value to the sector. To be conducted in three sessions, it will provide not only key knowledge to students and researchers, but also useful information to stakeholders.

Target audience: UTAD post-graduate students, UTAD teaching and research staff, relevant partner institutions and other scientific actors.

utad · CITAB · PIK · Università degli Studi Firenze · Luxembourg Institute of Science and Technology LIST · spi Sociedade Portuguesa de Inovação

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement nº 810176. This document reflects only the author's view and the Commission is not responsible for any use that may be made of the information it contains.

Vines & Wines, Forest and Food as key investigation for CITAB

UTAD joined three Collaborative Laboratories (CoLAB) that aim to stimulate the creation of qualified employment, to generate knowledge and economic value, to become examples of key innovation infrastructures for the development of Portugal. CITAB will closely collaborate in these CoLABs by involving their researchers in these laboratories.

The CoLAB *"Vines & Wines"* aims to increase the volume and value of Port wine in the world market, as well as the search for efficient responses from economic agents to the processes of climate change. This CoLAB consortium includes six institutions, with ADVID as promoter, bringing together universities, the business sector and R&D Institutions around the success of national winemaking, especially the collective brands "Wines of Portugal" and "Port Wine".

CoLab *Vines&Wines*.

The CoLAB *"ForestWISE – Collaborative Laboratory for Forest and Fire Integrated Management"* aims to drive forward all agents of the forest sector through developing research and development, innovation and transfer of knowledge and technology in order to preserve the sustainability of the forest resources, to minimize the risks of the wildland fires and to optimize the benefits of the forest to the society. The consortium comprises sixteen institutions including the main national universities, R&D centers, industries and forestry agents of Portugal.

CoLab *ForestWISE*.

The CoLab *"4FOOD-Collaborative Laboratory for Innovation in the Food Industry"* aims to promote a paradigm change in the collaboration framework between stakeholders from the food sector. It will act as a process that flows from the business sector to the non-business entities of the research and innovation system. While business-related entities play a leading role during this process, the R&I system will be active in order to meet the needs and expectations of the food sector, providing scientific and technological competences to solve large-scale problems. The consortium comprises fifteen institutions including main national universities, R&D centres and main stakeholders of the food sector, such as PortugalFoods and the Sumol-Compal and SuperBock groups.

CoLab4Food

CITAB research in climate change stressors mitigation is applied by wine producers

Kaolin, as protective agent of leaves and grapefruits during periods of severe summer stress is a work being developed by researchers from CITAB (UTAD and UM), among others. The experimental studies have been carried out on commercial vineyards (properties of Quinta do Vallado and Real Companhia Velha in Douro Valley; Herdade do Esporão in Alentejo Region) and is now being applied by these wine producers. The research work has been published in scientific and technical journals and has been publicly recognized by Institutions linked to the wine sector, such as Fundação Maria Rosa (2015 award) and ADVID (2018 award). Also, in 2017 Aníbal Coutinho, a Portuguese oenologist and wine critic, chose the practice of foliar application of kaolin as the technology of the year (W2017 Awards), highlighting the virtues of this clay to protect grapevine leaves on very hot and sunny days.

Experimental setting at Quinta do Orgal (Quinta do Vallado), Vila Nova de Foz Côa.

ColUTAD® - Reaping the royalties after a long term investigation

UTAD transferred the commercial rights of ColUTAD®, a hybrid chestnut roostock to private nurseries. ColUTAD, a free pollinated hybrid (*C. sativa* x *C. crenata*), is a result from the research started in the 50´s by Columbano Taveira Fernandes, that is being continued by a group of CITAB researchers, coordinated by José Laranjo, aiming to find resistant genotypes to ink disease. ColUTAD is considered to belong to the new generation of chestnut rootstocks due to its agronomical characteristics: high ink disease resistance; low vigour trees allowing the installation of high density orchards; and its availability to crop, both as a rootstock to support *C. sativa* varieties grafting, or as a direct producer due to its good nut quality. A royalty from each sold plant will be received by UTAD, being expected the production and selling of about 20 000 new plants in the forthcoming years.

ColUTAD Protocol signing ceremony

CITAB researchers create three Spin-offs

Spawnfoam is a spin-off in the agro-food and biotechnological areas, founded by Guilhermina Marques (CITAB) and Pedro Mendes, a mechanical engineer graduated at UTAD. This spin-off aims the development of biocomposites using materials of lignocellulosic origin and other by-products of the forestry and agro-food sectors, in order to *promote* environmental sustainability. The major goal of *Spawnfoam* is to be the reference in the market of innovative biodegradable materials, showing a valuable alternative to production and consumption of oil-derived materials and composites, such as plastics. *Spawnfoam* has been testing biodegradable pots and boards for thermal and acoustic insulation with partners and potential customers. *Spawnfoam's* motto is "Working with nature" and the company is trying to develop biomaterials to be used in the packaging of food and other goods. *Spawnfoam* has gained several prizes and is supported by the Portuguese Environmental Fund that has as one of the main objectives the transition of the Portuguese economy to a circular economy.

Ruralidade Verde is a spin-off in the area of agricultural and farming services, being a Field lab for farming knowledge transfer. A special focus is taken on increasing the capacity of innovation, generation and transfer of technical and scientific knowledge to farmers, colleagues and students, in order to promote rural development. This enterprise services include direct consulting to farmers and/or farmers technicians, promotion of courses/seminars/lectures and practical demonstrations. *Ruralidade Verde* is a partner, among other projects, of the ERASMUS+ project “ANICARE / 2017-1 - FR01-KA202-037287 - Erasmus +” on Key Action 2: “Cooperation for innovation and the exchange of good practices, strategic partnership in the field of education, training and youth”; and participates on several national and international networks, such as the European Federation of Animal Science and Rede Rural Nacional.

On November 2018 was approved a new spin-off UTAD, named *Tree Plus*. This spin-off was initiated by Luís M Martins (CITAB) with graduated students from UTAD. The company aims to develop projects related to forestry, urban forest and landscape architecture. The projects and studies developed by *Tree Plus*, accounts to the knowledge of different specialties due to the different background of the staff, based on research developed.

FP7 project EUROLEGUME brought novel legume based food products

In the year 2017 ended the international project *EUROLEGUME- Enhancing of legumes growing in Europe through sustainable cropping for protein supply for food and feed* (2014-2017) funded by the 7th Research and Innovation Framework Programme of the European Union and coordinated by Eduardo Rosa, former CITAB Director.

New products developed under *EUROLEGUME* project.

This project aimed to deliver an updated biochemical, nutritional and morphological description of valuables genotypes of faba beans, peas and cowpeas, as well as biological methods to enhance its nutritive value of their residual biomass and the development of new feed and food products. According the project coordinator, "the results of this project did fostered the scientific and technological progress of the legume value-chain, by the selection and characterization of valuable genetic plant resources by advanced molecular biology tools, NIR and root phenotyping. The project did brought new insights and improvements on the three crop management practices, such as rotations, intercropping and growing legume crops with inoculation with specific strains of Rhizobium and arbuscular mycorrhizal fungi (AMF). One of the other major achievements was the development of novel legume based food products such as snacks, and breakfast cereals, pea puree, pesto sauce from faba bean seeds, and the so called "blue mold cheese" made of faba bean. The project also developed new feed products which have been shown to improve the quality of the milk and meat".

Overall, the outcomes of this project achieved a great impact on the legume production chain across Europe. Apart from have identified the best cultivars, featured by the best phenotypical adaptation (external morphological parameters) and yield and quality parameters (i.e. protein and amino acid content), the experiments revealed the economic feasibility of growing faba beans in different latitude. In addition, addressing the best agricultural management practices for improving sustainability, it is possible to include any of these three legume species in crop rotations with other horticultural crops, providing multiple benefits for the legume crop, for other crops, for the income for farmers, for the environmental sustainability, and for the overall competitiveness of the European farming system. However, specific attention should be given to the cultivars traditionally used and thus adapted to each specific growing environment.

ALICE - Improving the management of Atlantic landscapes: accouting for biodiversity and ecosystem services


ALICE's Project team.

ALICE is an Interreg Atlantic Area project dedicated to improve the management of coastal and terrestrial landscapes in the Atlantic Area, involving several CITAB researchers. The project aims to develop an integrated approach considering the relationships between human activities, ecosystem service provisioning and biodiversity, through the implementation of Blue and Green Infrastructures to adapt to climate change. Multi sectoral participation will take place through an innovative participatory process fostering local knowledge and the involvement of relevant stakeholders. Last September, *ALICE's* partners met in France to start developing ecological models for the 4 case studies (Portugal, France, Ireland/UK and Spain) and discuss the project's future steps. *ALICE* CITAB's coordinator Edna Cabecinha presented the project in the ESP European Conference 2018, held in San Sebastian from October 15th to 16th.

INTERACT-ISAC - Improving olive orchards cropping practices to cope with a changing environment

INTERACT researchers Ivo Pavia, Luís Pinto, Cláudia Castro, Sandra Martins, Cátia Brito, Helena Ferreira, Ermelinda Silva, Carlos Correia, Luís Rocha, and Alexandre Gonçalves.

The researchers Carlos Correia, Alexandre Gonçalves, Luis Pinto and Cátia Brito, along with some PhD students from the AgriChains doctoral programme integrate the *INTERACT - Integrative Research In Environment, Agro-Chains and Technology* project, within the *ISAC line - Innovation for Sustainable Agro-Food Chains*. This group working on task 3 "Improving olive orchards cropping practices to cope with a changing environment", have been developing research together with ACUSHLA S.A., at their olive orchard in Lodões, Vila Flor. The main objective is to evaluate the introduction of innovative agricultural and technological practices to cope with a changing environment and increase the sustainability of the olive sector. A set of experiments were implemented involving soil and water management, and during summer, the physiological and biochemical responses of the plants were monitored. Recently, the researchers proceeded with the harvest to assess the influence of the new management practices on yield, and performed the olive oil extraction for quality analysis. The partnership established with Acushla S.A., one of the largest organic producer in the region of Trás-os-Montes and Alto Douro (300 ha with around 70.000 olive trees), already resulted on a more recent project, "New management practices in rainfed olive orchards: strategies for mitigation and adaptation to climate change", together with other olive/olive oil producers/stakeholders.

Cooperation with national stakeholders – Operational Group's projects

PDR2020 PROGRAMA DE DESENVOLVIMENTO RURAL 2014·2020

CITAB participates in fifteen Operational Group's projects promoted by stakeholders from the private sector. These projects, funded by Portuguese Rural Development Programme (PDR2020) envisages the reinforcement of links between universities, technical schools, research centres and micro, small or medium-sized enterprises, cooperatives or other forms of associations to solve concrete problems or to seize opportunities that are placed in the agro-forestry productive sector, with a view to increase productivity and promote sustainability with innovation. Among those fifteen, we highlight the projects *"GO-ValorCast-Valorization of the chestnut and optimization of its commercialization"* aiming the reduction of the chestnut fruits depreciation in the commercialization and processing circuit; *"GO-CSInDouro-Mating disruption against the grape berry moth, Lobesia botrana (Denn. & Schiff.), in mountain viticulture"*, aiming the evaluation of the impact in the distribution of pheromone in climate, landscape and vineyards to control this pest; *"GO-Cereja de Resende-Valorization of the Resende cherry production and positioning in the market"*, aiming the development of innovative orchard management strategies to increase yield and cherry quality; *"GO-Phytosanitary protection strategies for sustainable apple production"*, aiming the reduction of pesticide application and the study of supporting practices and methods for pests and diseases control of apple orchards; *"GO-BioChesnut-IPM-Implementation of efficient control strategies against chestnut and almond trees diseases"* - aiming the development of biologic control methods against chestnut and almond blight and the application of biological and evaluate the cultural methods to control the chestnut ink disease; *"GO-BioPest-Integrated Strategies for Combating Key Pests in Dried Fruits"* aiming the development of protection strategies to improve and solve the phytosanitary problems of chestnut, almond and walnut, through the biological protection of conservation and the application of biological and biotechnical means; and *"GO-PrevCRP-Development of integrated strategies to the Pine Pinch Canker prevention"* aiming the assessment of the most efficient methods in the control and elimination of *F. circinatum* from *Pinus* spp. seeds and nurseries containers. In these projects, CITAB researchers are deeply involved in technical and scientific activities with different stakeholders such as: REFCAST (Portuguese Association of Chestnut); Cooperativa de Penela, Companhia Geral da Agricultura das Vinhas do Alto Douro; Quinta D. Matilde – Vinhos Limitada; Quinta do Vallado-Sociedade Agrícola Lda and Sogevinus Quintas S.A.; CERMOUROS, MULTIPLOSFRUTOS, Municipality of Resende, Dolmen Association, Associação de Fruticultores de Armamar (AFA), Cooperativa Agrícola do Concelho de Armamar; AFUVOPA (Associação de Fruticultores, Viticultores e Olivicultores do Planalto de Ansiães, ABPRT (Associação de Beneficiários do Perímetro de Rega do Temilobos), nurseries of Germiplanta, Furadouro and Pombalverde and Ansub - Associação dos Produtores Florestais do Vale do Sado, among others. Other national private and public entities such as Instituto Superior de Agronomia, Instituto Politécnico de Bragança; Instituto Politécnico de Viana do Castelo, Instituto Nacional de Investigação Agrária e Veterinária, and Direção-Geral de Alimentação e Veterinária are also relevant partners of the project consortiums.

Science for the youth

"Ciência p'ra que te quero" is an outreach project for children from 6 to 10 years promoted in collaboration by CITAB - UM researchers and other from the Scientia.com.pt group of the School of Sciences of the University of Minho. The project aims to engage children in science in a pleasurable, appellative and efficient way, showing that science is everywhere and in everyday life. In 2018, *"Ciência p'ra que te quero"* was conceived and designed on behalf of the "European Year of Cultural Heritage" and had sustainability and patrimony as the main themes. The addressed topics covered subjects such as: "Is your house sustainable? Let's save the Cultural Heritage"; "The sustainability of liquids that are also patrimony", "Food – from sustainability to patrimony" or "Earth: a planet of waste?!" among others. Usually, a set of 5–6 simple and small hands-on experiments is offered in each session, which is performed monthly, every third Saturday, in a public library in Braga.

Detail of one of the six activities of the "Ciência p´ra que te quero" session entitled *Food – from sustainability to patrimony.*

Small scientists, great achievements

Ciência Viva in the Laboratory's participants with their supervisors and proudly showing their work.

In 2018, six activities of the *"Ciência Viva in the Laboratory - Scientific Occupation of Young People on Vacation"* event took place at CITAB with students aged 16-18 coming from different parts of Portugal. The educational and scientific activities aimed to promote the contact of young people with science, stimulating the contact between students, science and researchers. The activities involved CITAB researchers João Carrola, Sandra Mariza Monteiro, Eunice Bacelar, Berta Gonçalves, Ana Coimbra, Maria José Saavedra, Ana Barros, Paula Oliveira and Bruno Colaço.

CITAB research presented to the youngsters

Primary school students in the Forest Products Lab.

On November and December, CITAB researchers received and visited students from several schools of Vila Real (Escola Primária EB2, Jardim de Infância de Torneiros, Escola do Bairro S. Vicente de Paula, Colégio da Boavista and Escola de S. Pedro), to present their work to students aged from 3-17. In the Forest Products Laboratory, coordinated by José Lousada, the visit was divided into two activities: a visit to the arboretum, where they learn the growth processes of the trees and performed the dating of two trees; and a visit to the laboratory, where they observed under the microscope several types of wood and learn the main structures/cell types of the wood and their function. At schools, Bruno Colaço and Tânia Martins disclosed the health benefits of *Brassicas* consumption, giving children the chance to touch these vegetables and taste a Broccoli biscuit. Paula Oliveira presented the importance of the use of animal models in biomedical research, while Valdemar Carnide, Isaura Castro and Márcia Carvalho showed how plant DNA can fight climate changes.

Left - Learning mouses' administration; **Center** - Kindergarden children eating broccoli biscuit; **Right -** High School students analysing legume seeds.

CITAB and CIIMAR united on environmental research

The estuaries as typical interface environments between terrestrial and coastal landscapes, covering relevant gradients of biodiversity values and ecosystem services.

CITAB and CIIMAR - Interdisciplinary Centre of Marine and Environmental Research signed a cooperation protocol on January 2018. The established protocol defined as strategic priority areas the marine and environment sciences, including ecology, hydric resources management, environment impact assessment, ecotoxicology, biotechnology and aquaculture. As first joint initiative, CITAB and CIIMAR are preparing the organization of an international workshop on the theme “Ecosystem Services in Interface Environments: Towards Social-Ecological Resilience, Health and Wellbeing from the Stream to the Coast”. The proposed workshop will pay special attention to the demonstrative relevance of freshwaters, estuarine and coastal ecosystem services, by promoting the participation of different stakeholders, since they influence and are influenced by decisions on land uses management. This will illustrate how biodiversity and ecosystem services valuation can be incorporated into integrated landscape social-ecological management and planning involving stakeholders in natural resources protection.

Protocol established between CITAB and INESC TEC

Use of several monitoring strategies (field sensors and remote sensing using UAVs) to access vineyard dynamics and early disease detection.

The purpose of this Protocol is to define the strategic areas of cooperation between CITAB and INESC TEC - Institute for Systems and Computer Engineering, Technology and Science in the development of scientific activities recognized as being capable of integrating the research areas of the two research units. The priority areas of cooperation between the two research units are: the valorization of waste from the agri-food industry, water and its nutrients; the evaluation of resources in order to increase the use of biomass for energy production; the use of IoT (Internet of Things) for solutions in the agro-forestry, environmental, and biological domains. In 2017 December 6, took place at UTAD, the first CITAB - INESC TEC Research Meeting, in order to create synergies between the Centres, to enhance future joint applications to international projects.

Fourth edition of Do*Mar doctoral programme

The Welcome Session and Opening of the 2018/2019 Academic Year of the International Program on Marine Science, Technology and Management (Do*Mar) occurred in November 16th, the national day of the Sea, at UTAD.

The Do*Mar is an international doctoral programme offered by a consortium of Portuguese and Galician Universities (Aveiro, Minho, UTAD, Porto, Vigo, Compostela e Corunha), involving several CITAB researchers on the programme management and in students supervision. The St. Andrews University (Scotland), the Université Pierre et Marie Curie (France) and the Universidade de São Paulo (Brasil) are also associated members of this consortium. Do*Mar has currently more than 250 students and this year Portuguese universities received 7 new students.

Do*Mar students and teachers.

Technologies for mitigating greenhouse gas and ammonia emissions from agriculture and livestock production

Agriculture and livestock production are major contributors to anthropogenic greenhouse gas (GHG) emissions and hence to global warming. For this reason, in the 2030 climate and energy framework of the European Commission, the European Union (EU) has committed to reduce GHG emissions from animal waste and agriculture in 2030 by 30% comparing to 2005. The two major GHG emitted by the agriculture/livestock sector are methane (CH_4), which is released mostly by enteric fermentation of ruminants, manure storage and management and rice cultivation; and nitrous oxide (N_2O), released mostly from agricultural soils amended with synthetic or organic fertilizers. Agriculture is also the dominant source of ammonia (NH_3) in the atmosphere, with land application of manure as a major component.

Different types of chambers used to measure gaseous emissions.

In this framework, the Agriculture and Environment Lab aims to develop innovative technologies for the mitigation of GHG and NH_3 emissions and reduction of the carbon footprint in the agriculture/livestock sector, while improving its productivity and competitiveness. This Lab (coordinated by Henrique Trindade) is equipped with four gas chromatographs, a portable photoacoustic gas analyzer and a chemiluminescence gas monitor which enable the analysis of greenhouse gases and other important gaseous compounds, namely CH_4, N_2O, NH_3, carbon dioxide (CO_2), nitric oxide (NO), nitrogen dioxide (NO_2) and hydrogen sulfide (H_2S). In addition, a set of structures and facilities is available for monitoring biological processes related to the nitrogen and carbon cycles, such as dynamic and static chambers, reactors for composting, scale models of animal housing floors, large-volume chambers with temperature control and also agricultural land. These facilities allow for step-by-step studies of animal manure management and for field trials, in a farm-scale approach.

Some examples of the technologies developed in the Agriculture and Environment Lab include: the addition of biochar (charcoal), sulphuric acid and biological additives to cattle-slurry during storage and field application to reduce emissions of pollutant gases and nutrient losses; adding feed and litter additives to improve broiler performance and to reduce ammonia volatilization from the poultry industry, such as clinoptilolite and De-Odorase®; inclusion of legume species in crop rotations to mitigate GHG emissions from crop cultivation, reducing the need for synthetic N fertilizers and to increase soil carbon storage; and selecting adequate cover crop species for GHG mitigation and better yields in typical Mediterranean perennial crops such as vineyards and olive orchards.

CITAB is currently involved in two main projects within this thematic: *INTERACT - Integrative Research in Environment, Agro-Chain and Technology* (2016-2019, NORTE-01-0145-FEDER-00017) and *AMONIAVE - Techniques for reducing ammonia concentrations in poultry houses* (2016-2019, POCI-01-0247-FEDER-003430), in cooperation with LUSIAVES and Instituto Politécnico Viseu. These are focused in the evaluation of NH_3 and GHG emitted from animal and crop production systems, namely from agroecosystems amended with different organic and mineral fertilizers. Other projects have recently supported this research area in CITAB, such as *EuroLegume - Enhancing of legumes growing in Europe through sustainable cropping for protein supply for food and feed* and *ReUseWaste - Recovery and Use of Nutrients, Energy and Organic Matter from Animal Waste*.
With these and upcoming projects, CITAB will continue providing the EU with tools and solutions that can help it attain the GHG emission reduction goals in the agriculture and livestock sector.

Portable photoacoustic gas analyzer.

Composting reactors.

Sofia Alves Pimenta

Anatomical and imaging studies of the humeroulnar congruity in dogs

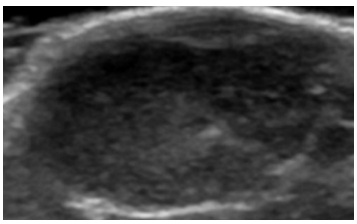
CITAB researcher Sofia Alves Pimenta obtained her PhD degree on March 2017, with a thesis on the *"Anatomical and imaging studies of the humeroulnar congruity in dogs"*. The development of software applications for medical image analysis has improved clinical diagnosis in several areas of medicine. The prediction of elbow incongruity is a relevant topic in dysplasia, a common disease in veterinary orthopedics, affecting young large-breed dogs, with significant economic and life quality impact. A software developed by Pedro Melo-Pinto (CITAB) and Armando Fernandes (former CITAB member) was validated to assess elbow congruity on radiographic and computed tomographic (CT) images. A methodology for humeroulnar curvature radii evaluation at the subchondral bone level was described. Anatomical techniques were applied to study the joints of two Portuguese autochthonous breeds, Estrela mountain dog and Portuguese pointing dog. Differences in curvature shape found between breeds were associated to the pattern of bicentric load transmission through the elbow joint described in large-breeds, more prone to dysplasia development. Results from articular cartilage covering were in compliance to the curvature shape. Sofia's research provides valuable contributions for elbow dysplasia diagnosis and the results represent an advance on the elbow congruity characterization. The research was based on the elbow joint of Portuguese dog breeds. However, the developed processes and procedures can be extended to other joints, dog breeds and also human health purposes. The results from this research were published in six JCR journal articles and presented in several congresses. The supervisors were Bruno Colaço and Mário Ginja (CITAB).

Humeral and ulnar curvatures were traced by a curve fitting process, on radiographic and computed tomographic (CT) images, above. Differences between breeds were associated to the pattern of bicentric load transmission through the elbow joint described in large-breeds (red). Medium breed (blue), below.

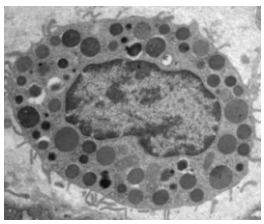
Ana Faustino

Mammary carcinogenesis in female rats: contribution to monitoring and treatment

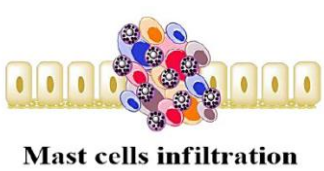
CITAB researcher Ana Faustino successfully defended her PhD doctoral thesis *"Mammary carcinogenesis in female rats: contribution to monitoring and treatment"* in May 2017. Breast cancer is the most frequent cancer among women, being responsible for more than a half a million of deaths in 2015. Although several medical options are available for breast cancer treatment, the possible ineffectiveness, the distinct response of cancer to the therapies and the devastating effects of some of these therapies for patients are the major concerns in cancer treatment. This work intended to contribute to the monitoring and treatment of mammary cancer using a rat model. For this, mammary tumor growth and vascularization were non-invasively evaluated by imaging modalities, and two distinct therapeutic approaches were tested: the role of lifestyle (practice of physical exercise) and the effects of the second-generation H1-antihistamine and mast cell stabilizer drug - ketotifen. The practice of moderate exercise training for a long period of time and the administration of ketotifen are recommended for mammary cancer prevention and treatment. The study was funded by the Portuguese Foundation for Science and Technology (PhD grant SFRH/BD/102099/2014) and supervised by Mário Ginja (CITAB), Rita Ferreira (QOPNA-UA) and Adelina Quaresma (CECAV-UTAD).



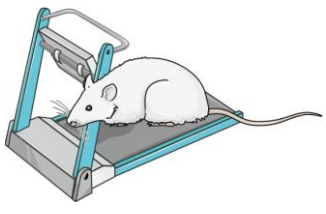
Evaluation of a mammary tumor by ultrasonography.



Electron microscopic imaging of a mast cell.



Tumor microenvironment (mast cell infiltration).

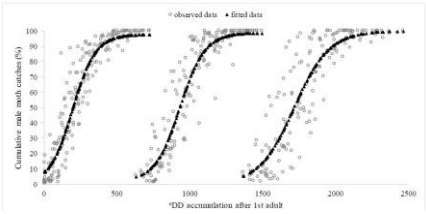


Effects of exercise training in a rat model.

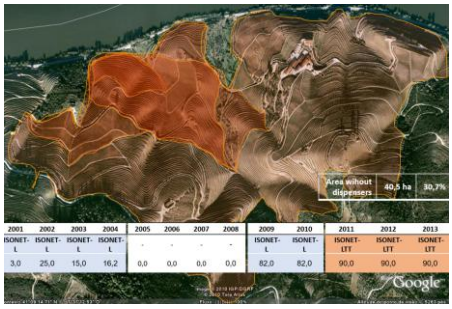
Cristina Carlos

Towards a sustainable control of arthropod pests in Douro Demarcated Region vineyards with emphasis on the grape berry moth, *Lobesia botrana* (Denis & Schifermüller)

CITAB researcher Cristina Carlos, successfully defended her doctoral thesis *"Towards a sustainable control of arthropod pests in Douro Demarcated Region vineyards with emphasis on the grape berry moth, Lobesia botrana (Denis & Schifermüller)"* in July 2017. The aim of the thesis was to contribute to the development of an environmentally sustainable pest management strategy for controlling main arthropod pests in Douro Demarcated Region (DDR) vineyards, with emphasis on the grape berry moth, *Lobesia botrana*, a key-pest of the crop in this region. Due to the impact of this insect species in quality of wines produced in DDR, the increasing regulation of pesticides in Europe, and the increasing interest for sustainable production approaches, the goal was to develop an effective control strategy against this pest, based on conservation biological control, mating disruption technique and phenological models to better timing sampling or control operations and improve Integrated Pest Management tactics, providing the wine production sector with useful tools for increasing its sustainability at both economic and environmental levels. The supervisors were Laura Torres and António Crespí (CITAB). The thesis was funded by ADVID, by "Fundo Europeu Agrícola de Desenvolvimento Rural: A Europa investe nas zonas rurais", through PRODER (Med. 4.1 PA 24042 e PA 24043) and through the QREN Operational Competitiveness Programme).



Cumulative male trap catches of *L. botrana* for the first, second and third flights vs DDº. using first male catches as biofix. DDR (1989/1991, 2000/2013).



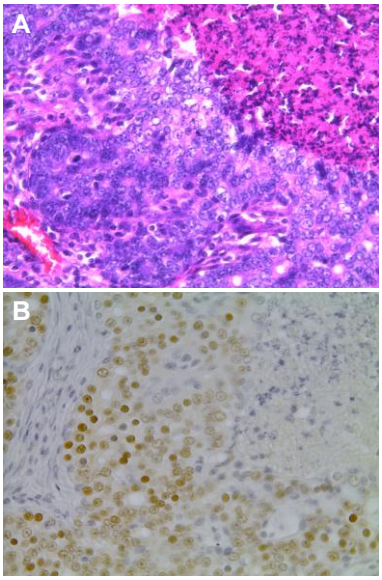
Surface under mating disruption at S. Luiz estate.

Morphospecies database created with material caught during the thesis.

Antonieta Alvarado Muñoz

Histopathology and immunohistochemistry characterization of mammary lesions chemically-induced by 7,12-dimethylbenz(a)anthracene and 1-methyl-1-nitrosurea in female Sprague-Dawley rats

CITAB researcher Antonieta Maria Alvarado Muñoz defended her doctoral thesis *"Histopathology and immunohistochemistry characterization of mammary lesions chemically-induced by 7,12-dimethylbenz(a)anthracene and 1-methyl-1-nitrosurea in female Sprague-Dawley rats"* in November 2017. Her work aimed to evaluate the immunoexpression of the prognostic factors ER, PR, Ki-67 and MAI, in MNU and DMBA-induced mammary tumors in female Sprague-Dawley rats, evaluate the effects of lifelong exercise training on the immunoexpression of ER , Ki-67PI and MAI, the development of breast cancer metastasis, as well as a characterization of those metastatic lesions in MNU-induced mammary tumors in female Sprague-Dawley rats. The behavior of MNU and DMBA-induce mammary tumors related with the prognostic factors, as well as the effects of exercise training at different stages of carcinogenesis led to the conclusions of rat mammary tumors derived from animals subjected to long-term exercise training are less proliferative and more differentiated, suggesting that the long-term exercise training induces a better therapeutic prognostic and decreases the risk of lung metastases. This work was funded by FCT-Portuguese Foundation for Science and Technology, under the project PTDC/DTP-DES/6077/2014. The supervisors were Bruno Colaço and Paula Oliveira (CITAB) and António Cabrita (University of Coimbra).



Microphotography of comedo carcinoma pattern observed in MNU-induced mammary tumors. **A**, H&E staining and **B**, ER immunoexpression (400X magnification).

II International SASGEO symposium + III INTERACT National Conference

The International Symposium Water, Soil and Geo was held at UTAD on 17th and 18th May. This event was part of the III Conference *INTERACT - Integrative Research in Environment, Agro-Chains and Technology*, a project that has a team of 80 researchers and staff divided into three lines of research: Innovation for Sustainable Agrifood Chains (ISAC); Bioeconomy and Sustainability (BEST) and Sustainable Viticulture and Wine Production (VitalyWine). During the symposium, several speakers from INTERACT presented the main achievements, together with invited speakers from Brazilian and other national research centers and universities. This Symposium showed the need for increasing technological development in agri-food, the importance in the dissemination of innovation to increase competitiveness and the need to cope agricultural production with the challenges imposed by climate changes.

EuroDairy Project - Efficient use of water in dairy production

The *EuroDairy* project, which includes researchers from CITAB, organized a workshop on the efficient use of water in the milk production sector, which is considered one of the current and future challenges on the milk production sector. This event took place on 18th and 19th June 2018, in the auditorium of AGROS which is a private company of the dairy sector and a stakeholder of CITAB and partner of the *EuroDairy* project. The first day of the workshop was dedicated to technicians (about 70), who had the opportunity to attend lectures by foreign researchers and to visit dairy farms. The second day was directed to producers (about 300), in which climate change and the importance of quality and quantity of water in cow feeding and the efficient use of this scarce resource in forage production was one of the topics highlighted. Henrique Trindade, CITAB´s researcher and national coordinator of the *EuroDairy* project, explained, "The main objective of the workshop was to present the most advanced methodologies and techniques related to the rational use of water, which we consider to be one of the current and future challenges in the sector of milk production, leading researchers to share information with producers of milk. The producers are aware of many of the themes, but they always want to find more and updated information, in particular as regards the efficiency and good practices that can be adopted in their holdings to ensure the welfare of their animals, and to improve the efficiency in the use of their resources contributing to the protection of the environment", concluded the responsible. The *EuroDairy* project, funded by the Horizon 2020, aims to establish lines of communication and cooperation between European producers of cattle for milk and has the participation of 14 countries, namely Portugal, United Kingdom, Netherlands, Sweden, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, Poland, Slovenia and Spain.

International Conference on Medicinal Plants and Bioeconomy & The 1st Sino-CPLP Symposium on Natural Products and Biodiversity Resources (ICMPB & SNPBR 2018)

The ICMPB & SNPBR 2018 that took place in August 22nd-24th in Macau was co-organized by CITAB. At the conference, Alberto Dias (CITAB-UM) presented two lectures: “At Plant, From Lab Bench to Bedside: A Translational Approach” and “Opportunities for plant research under the SINO-PT consortium”. Also during the meeting, a SINO-CPLP cooperation consortium was established between Macau University, Minho University, University of Hong-Kong, São Paulo University and the Tshwane University of Technology.

Did you know that?

Scientific merit of CITAB's researchers have been recently recognized by international and national institutions

Paulo Fernandes was chosen by his peers to be Member of the Board of Directors of the International Association of Wildland Fire for the period 2013-2018. This researcher also participated in two independent commissions nominated by the Portuguese Parliament to analyze the 2017 fires and has been nominated as an expert of the National Committee for Forest Fires.
He is also the new member of the Editorial Committee of “Forest Ecology and Management”, one of the most prestigious scientific journal in the forestry area.

Ana Barros has been nominated by the Portuguese Foundation for Science and Technology as an expert in “Circular Economy” and by UTAD as the institutional representative on the “Mediterranean Diet Safeguard” network.

Rui Cortes has been indicated by the Portuguese Parliament as an expert of the National Committee for Forest Fires.

José Gomes Laranjo was nominated Chairman of the Chestnut Workgroup from International Society for Horticultural Science for the period 2017-2018.

Ana Sofia Santos was elected as President of the Horse Study Commission, from the Federation of Animal Science (2014-2020) and as President of the Portuguese Zootechnical Engineering Association.

Maria Emília Silva was elected President of the Portuguese Society of Forestry.

Domingos Lopes was awarded the Prize “Vicente Ferrer” by the municipality of Lousã in recognition of his career.

Helder Fraga was one of the researchers selected by "Scientific Employment Stimulus”, a national program from the Portuguese National Foundation of Science and Technology that supports directly the recruitment of young researchers (PhD) with recognized curriculum, to continue their research in crucial areas. His research is centred on the impact of climate change on viticulture. He defended his PhD thesis in 2014, with a classification of 20 values in a scale of 20, being considered "Outstanding" by the jury.

Lia-Tânia Dinis, José Moutinho Pereira, Carlos Correia, Ana Luzio and Aureliano Malheiro won the 2017 Research Prize from Maria Rosa Foundation with the work “Ecophysiological and molecular approach to wine mapping in the Douro Region (EcoVitiDouro)”.

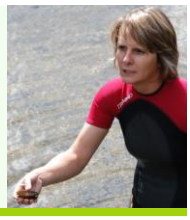
Did you know that?

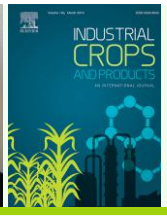
Lia-Tânia Dinis, Sara Bernardo, Artur Conde, Helena Ferreira, Luís Félix, Hernâni Gerós, Carlos Correia and José Moutinho-Pereira were distinguished with the ADVID Prize - Prof. Dr. Pedro Amaro, with the work: "The exogenous application of kaolin increases the antioxidant capacity and the content of phenolic compounds in extracts of leaves and fruits of vine under summer stress." The award ceremony took place on April 20, 2018, in Régia-Douro Park.

Antonieta Alvarado received the "Annual Award for Research of Lisando Alvarado" for the Best Scientific Work published in the area of Veterinary Sciences. This prize was awarded by the Bolivarian Republic of Venezuela and by the University Centroccidental Lisandro Alvarado – UCLA, in recognition of her work carried out under her PhD, with the theme "Prognostic factors in the animal model of breast cancer", with supervision of UTAD-CITAB researchers, Bruno Colaço and Paula Oliveira and the researcher António Cabrita from University of Coimbra.

Ana Barros, Irene Gouvinhas, Rafaela Santos, Marcelo Queirós and Maria José Saavedra work "Use of grape stems as an alternative to oak wood in wines aging" received in 2017 an Honorable Mention also by the Maria Rosa Foundation.

Simone Varandas is part of the team that will produce the "Red Book of Invertebrates" in Portugal, more specifically in relation to freshwater bivalves (naiads and spherids). The work includes updating of distributions and status of populations, evaluation of their threat status according to IUCN criteria and cartography.





Alfredo Aires was invited for the Advisory Board of "Industrial Crops and Products", a prestigious scientific journal in the agro-food area.

Ana Barros and Irene Gouvinhas were awarded the Best Communication Prize in the International Conference "Agriculture & Food Chemistry" (Euroscicon 2018), held in Rome in July 2018.

Three 'Proof of concept' were awarded under the UPGRADE@UTAD programme, from UNorte Inova project. The prizes, of 14 thousand euro each, will support the practical application of results from promising research in the three approved projects: "StemEcoWine- Alternative use of oak wood in wine aging: stems as an ecological and economic proposal", from Ana Barros; "Radiographic diagnosis of hip dysplasia in the dog without human exposure to ionizing radiation (DASRAD)" and "SAPOIM-Software for Evaluation of Orthopedic Parameters in Medical Imaging", from researchers Mário Ginja, Bruno Colaço, Sofia Alves Pimenta, João Martins and Ana Santana.

Fátima Gonçalves, Laura Torres and Cristina Carlos published the book *The soil of Douro Demarcated Region vineyard is alive!* in late 2018. This book aims at providing a brief description of the main groups of arthropods identified in the soil of Douro Demarcated Region vineyards, with reference to the ecosystem services they provide. Besides contributing to the sustainable management of the vineyard ecosystem, some of the reported species are endemic and rare and can, therefore, play a role in enhancing the natural value of Douro viticulture landscape.

Short notes & Upcoming events

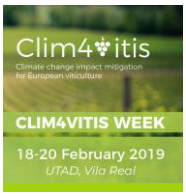
Working Group on Resilience and Marine Ecosystem Services

Edna Cabecinha is a member of the International Council for the Exploration of the Sea (ICES) integrating the Working Group on Resilience and Marine Ecosystem Services (WGRMES). This year the annual meeting occurred in 19-20th November 2018, in the Toralla Marine Science Station (ECIMAT), the main marine research infrastructure of the University of Vigo to discuss important topics related to Marine Ecosystem Services (ES). The Blue growth agenda, synergies and trade-offs, social transformations and governance related to scenarios for marine-coastal ES, were some of the topics discussed. This Working Group pretends to effectively design mechanisms from science to decision-making process to find the best alternative strategies for the use of ecosystem services by governments, the scientific community, and stakeholders.

FCT Pluriannual Evaluation 2017/2018-International Evaluation Panel Visit

In the scope of the national R&D Units evaluation exercise, CITAB received the visit of the FCT International Evaluation Panel on the 17th October 2018. The panel was composed by eight European scientists with expertise on agriculture, vegetal production, food technology, forestry ecology and animal nutrition. A delegate from FCT and the UTAD Vice-rector for Research and Innovation were also present, as most of CITAB researchers. The preparation for this visit involved a previous meeting, 3rd October, with the Stakeholders Commission, that includes delegates from entities/enterprises of the most representative sectors englobed by the centre's research: António Graça (ADVID), Luís Rochartre (WBCSD), João Miranda (FRULACT) and Francisco Carvalho (AMORIM FLORESTAL). From this meeting resulted relevant recommendations on how to present the Centre to the evaluation panel and for CITAB future strategy.

Upcoming events



Clim4Vitis Week - Climate Change impact mitigation for European viticulture
From 18th to 20th February 2019 the H2020 project Clim4Vitis will promote: «Grapevine Modelling Workshop», «Clim4Vitis Conference» and «Climate Change Viticulture Course».
Free registration!

More information available at : http://clim4vitis.eu/

Digital Agro-forestry (r)Evolution
International Conference, held at UTAD from 12th to 13th December 2019.

Ecosystem services in interface environments: towards social-ecological resilience, health and wellbeing from the stream to the coast
International workshop, held at UTAD on the 2nd semester 2019

Location and contacts

CITAB - Centre for the Research and Technology of Agro-Environmental and Biological Sciences

University of Trás-os-Montes and Alto Douro
Quinta de Prados, Laboratorial building,
Room C1.10
5000-801 Vila Real - Portugal

University of Minho
Campus de Gualtar
4710-057 Braga - Portugal

Phone: +351 259 350 475
email: citab@utad.pt
website: www.citab.utad.pt

/CITAB.UTAD

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