PS – R22

4. Biotechnological food and biofactories

Nitric oxide modification of plant endocytosis and PIN1 localization

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Nitric oxide (NO) has a remarkable range of signaling functions during plant developmental processes and stress responses, which stems from NO ability to modulate phytohormonal pathways at multiple levels. Plant growth regulators auxin and NO are involved in root morphogenesis. Here we report the role of the NO/auxin crosstalk in this process and seek to integrate seemingly opposite NO-mediated effects on auxin signaling into an encompassing model of root development. Pharmacological and genetic approaches helped unravel the role of NO in establishing auxin distribution patterns necessary for stem cell niche homeostasis and root meristem organization, and we carried out GFP and immunolocalization analyses to deepen our understanding of auxin transport regulation. Our results reveal that NO-mediated alterations in root development can be partly ascribed to a reduction in auxin transport, explained by alterations in the cytoskeleton and cytoskeleton-controlled processes such as endocytosis.

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PS – R23

4. Biotechnological food and biofactories

Isolation and characterization of yeast from artisan sourdoughs for innovative baking processes

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Sourdough is a mixture of flour, water and communities of lactic acid bacteria and yeasts. The flour type, temperature and refreshment timing influence the final microbiota of mature sourdoughs, which provides specific organoleptic and structural properties to artisan baking goods.

To satisfy the current demand of increasing the genetic diversity and repertory of baker's yeast available, we isolated and identified 50 autochthonous yeasts from 7 sourdoughs of wheat, rye or *Tritordeum* flours, 33 of the genus *Saccharomyces* (*S. cerevisiae* and *S. kunashirensis*) and 17 of 8 different genera (*Candida*, *Cryptococcus*, *Filobasidium*, *Pichia*, *Sporobolomyces*, *Rhodosporidium*, *Torulaspora* and *Zygosaccharomyces*). We quantified 3 physiological traits: (i) dough leavening capacity on wheat and *Tritordeum* flours, (ii) CO_2 production and (iii) maltase activity. In general, *S. cerevisiae* strains produce equal or higher CO_2 levels and display similar maltase activity than commercial baker's yeasts of reference. Conversely, *S. kunashirensis* strains are particularly efficient in sweet dough fermentation, but their maltase activity is undetectable. Yeasts from the other genera exhibit low values for the traits analysed, but some may provide desirable metabolites or organoleptic properties to sourdoughs.

In order to formulate innovative starters for the bakery industry, we carry out collaborative research to test the behavior of a set of yeasts in technologically innovative fermentation processes and the quality of the corresponding baking goods.

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PS – R24

4. Biotechnological food and biofactories

Exploitation of agroindustrial co-products to produce isoforms of phytases and proteases and promising applications for animal nutrition

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Utilization of agricultural co-products as substrate for solid state fermentation (SSF) was studied, aiming the achievement of novel enzymes from *Aspergillus niger* and *Aspergillus oryzae* with distinct biological characteristics and its application for improvement of animal nutrition. *A. niger* produced acid phytases, as for *A. oryzae*, optimum pH was basic; optimum temperature was 37°C for both fungi. Protease from *A. niger* showed very distinct behavior when different substrates were tested. On the other hand, proteases from *A. oryzae* were stable at all pH's and produced higher yields. Phytase and protease were stable at high temperatures. Subsequently, the upscale production of *A. niger* phytase and *A. oryzae* protease with 7000 U g^{-1} and 2500 U g^{-1}, respectively, were applied as additive in a plant protein based fish diet. They increased protein, mineral, energy and lipids availability, showing that these new enzymes can improve animal production and performance. In conclusion, the substrate, as well as, the microorganism species can affect the biochemical character of the enzyme produced. Moreover, the production of these enzymes by SSF can be up to 90% cheaper than

commercial ones and they can be easily applied as animal feed additives.

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PS – R25

4. Biotechnological food and biofactories

Inulinase activity of soybean and yacon meal fermented with *Aspergillus niger*

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The aim of this work was to evaluate the inulinase activity of *Aspergillus niger* 18 in soybean meal and *A. niger* 01 in yacon meal using solid state fermentation (SSF). Inulinase activity had optimum pH at 5 to *A. niger* 18 in soybean meal, reaching 3.4 U mL^{-1}, decreasing in pH 4 and 6. The maximum enzyme stability was between pH 4 and 5, decreasing in higher values. *A. niger* 01 in yacon meal showed a wide range of optimum pH, between 4 and 7, reaching above 4.0 U mL^{-1}, what indicates high versatility of this enzyme. The stability had similar results, showing none activity in pH higher than 8. The optimum temperature to *A. niger* 18 in soybean meal was 55 °C. The stability was below 55°C. The optimum and stability temperature of *A. niger* 01 in yacon meal had both an interesting result. The inulinase activity increased from 25 to 95°C, reaching more than 4.0 U mL^{-1}. In conclusion, the thermostability of the enzyme studied using yacon as substrate is convenient for industrial utilization and prebiotics production, plus the biochemical character of the enzyme varies depending on combination of substrate and microorganism.

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PS – R26

4. Biotechnological food and biofactories

New role of sawtooth transcription factors in the shift to photoautotrophic growth in plants

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DELLA proteins are central modulators of transcriptional circuits that transduce environmental signals to developmental processes. They interact physically with transcription factors (TFs) and alter their activity. One of them is SAWTOOTH2 (SAW2), a TF involved in the control of leaf shape through the limitation of growth in leaf margins by the repression of *KNOX* genes, including *KNAT1/BREVIPEDICELLUS*. Therefore, we pursued two questions: (1) Do DELLA proteins regulate KNOX activity through their interaction with SAW TFs? And (2) do SAW proteins have additional functions in development?

Here we further characterize the interaction, describing the protein domains involved and showing that DELLA proteins indeed interact with SAW2 in plant cells. Moreover, *KNAT1::GUS* expression was enhanced in Arabidopsis seedlings that accumulate DELLAs, suggesting that SAW protein activity would be inhibited by DELLAs.

Moreover, transcriptomic analysis of *saw1 saw2* seedlings indicates that the glyoxylate cycle is functionally repressed by SAW. In agreement with the need for an active glyoxylate cycle during germination, seedling establishment was improved in the *saw1 saw2* mutant, suggesting a new role of SAW proteins in the shift between heterotrophic and photoautotrophic growth.

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PS – R27

4. Biotechnological food and biofactories

Exploratory study of perception, information and knowledge about genetically modified organisms (GMO) in Colombia

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Due to the preconceived ideas that often have the population about biotechnology, this study has been structured to explore perception, information and knowledge about genetically modified organisms (GMO).

This is a pilot study, applied at the Universidad Antonio Nariño (UAN), whose objective was to structure and validate a methodology that can be applied in an analysis of national coverage, with the support of the Ministry of Health and Social Protection of Colombia.

The target population of the survey corresponds to students, teachers and administrators of the UAN (16,000), who were invited by email to participate through the institutional platform. It was a response of 1730 participants (10.8%), corresponding to 22 cities in different regions of the country. The 60% sample corresponded to students, 21% to teachers, and the 18% administrative.

The survey is designed with questions related to knowledge of the concept of GMO, its relationship with crops and food, information and the perception on the characteristics of the GMO and its consumption. Also included questions related to demographic information.