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Guaco, a case study of the influence of environmental factors on secondary metabolites of medicinal plants

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Rough estimates state that 65 to 8% of the world population use medicinal plants for cultural or economic reasons. However in certain cases the wrong species may be used or the environmental conditions under which a plant is cultivated my result in varying concentrations of bioactive chemical components, affecting the expected results. Two species of creepers, popularly known as *Guaco (Mikania glomerata* and *Mikania laevigata*) are popularly used for coughs, bronchitis and inflammations in Brazil. These two species are quite similar in appearance and are used interchangeably by the population. However studies by UHPLC-MS have shown that *M. glomerata* presents low concentrations of the marker compound (coumarin) and that the composition of both species varies significantly. Furthermore studies of the effect of damage, temperature, irrigation and intensity of light have been carried out on both species, using untargeted metabolomics, showing that they result in significant changes in the concentrations of specific secondary metabolites (mainly phenolic compounds). The results of these experiments indicate that the two species cannot be used interchangeably, due to differences in composition, and that environmental factors strongly affect their composition. Therefore caution must be exercised when planting and collecting medicinal plants to guarantee their safe and effective use.

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Metabolite profiling of nutrient-deficiency tolerant and nutrient-deficiency sensitive maize genotypes

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We have reported differential metabolic profiling of nutrient-deficiency and nutrient-deficiency sensitive maize (*Zea mays* L.) genotypes under the regimes of nitrogen (N) and phosphorus (P) deficiency and recovery conditions. The plants were grown hydroponically with +N+P, -N-P, +N-P and -N+P conditions. Metabolites profiling of leaf was carried using GC-MS and LC-MS. The results showed that there are significant changes in the metabolite profiling by nutrient stress. While the accumulation of di- and trisaccharides (maltose, sucrose and raffinose) increased, and the level of phosphate containing sugars like glucose-3-PO_4, fructose-1,5-bisphosphate and inositol-1-PO_4 decreases. It may be due to less consumption of phosphorus and rescue phosphorus from small phosphorus containing metabolites like organic acids. It was also observed that there is sharp increase in almost half of the amino acids mostly asparagine and glutamine and reduction in the levels of aspartate and glutamate, this may be due to protein degradation and repression of protein synthesis. During nitrogen limiting condition plants produce ammonia by converting asparagine, glutamine and glycine into aspartate, glutamate and serine respectively and hence acclimatize in the nutrient stress condition. The same trend was found in the amino acid content as reveled from the quantitative analysis of amino acids by HPLC. This study will help us how plants adapt to nutrient deficient conditions and survive by partitioning metabolites. Thus, we will be able to minimize the use of nitrate and phosphorus fertilizers and help in preventing the nitrate pollution and eutrophication of water bodies caused by inflow of phosphorus into them. In summary, plant metabolomics is a priceless tool for studying the plant genotypes that are exposed to different perturbations (genetic, environmental or modified genome).

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