SPECIAL ISSUE ON PLANT AND FOOD METABOLOMIC

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Foreword

Throughout the nineteenth century and for much of the twentieth century, the definition of secondary metabolites simply meant that these substances, while present in plants, did not participate in the metabolic processes essential to the life of the organism. They were defined as by-products of primary metabolism or as excretory products or final products of metabolism, always pointing out that their irregular presence on plants meant that they were not indispensable. Over the last 50 years, knowledge in this area has been greatly expanded, especially following the development of new isolation, separation and structural identification technologies (spectroscopy, nuclear magnetic resonance and mass spectrometry). The ease of structural identification has expanded the number of secondary metabolites to reach the unthinkable number of 200000 for many of which, however, remain uncertainty about their biochemical and physiological role. In recent years, however, many researches have progressively clarified the role of these substances and some of them are known to have a fundamental function. Thus it has been for shikimic acid, for many years considered a simple metabolite of *Illicium anisatum*, then revealed as a key molecule for synthesis of aromatic amino acids and, in turn, precursors of phenylpropanoids (flavonoids, coumarin, tannins and lignin). Certainly these are not secondary functions!

Primary metabolism is essential to plants for growth and development, and secondary metabolism helps plants to interact with the environment. Many plant metabolites are also industrially important (e.g.: the physiologically active alkaloids used in modern medicine). These metabolites are produced by plants through complex metabolic pathways.

Among the researchers in this area it is inevitable to remember J.B. Harborne, who has been devoting some 50 years to the study of flavonoids and, more generally, to chemical ecology and plant chemosystematics. Harborne's work has called for experimentation on all other classes of secondary metabolites, alkaloids, non-protein amino acids, glucosinolates, lectins, terpenes, steroids, tannins, flavonoids, phenylpropanoids, lignins, coumarin, waxes, etc. Plant secondary metabolites are critical to various biological processes.

The plant's specific organization has led it to produce a large amount of secondary metabolites and probably selective pressure has left those molecules capable of conferring specific benefits to the plant: defense role against animal, fungal and bacterial parasites, but also those molecules that allow to establish relationships between plants of the same species or between different species.

Numerous contributions to this special number of AHS are devoted to ecological biochemistry and that explains the "non-secondary" role of so many metabolites; It is also hoped that the molecular biological tools will spread to the labs in order to have accurate information on the genes involved in the various secondary metabolism.

Plant genomes are variously estimated to contain 20000-60000 genes, and perhaps 15-25% of these genes encode enzymes for secondary metabolism. Still a lot of research work has to be done both physiologically and biochemically on the secondary metabolism of many species, but I believe it is essential that laboratories use data availability about the genes of *Arabidopsis*, an extraordinary model species, involved in secondary metabolism.

Thus, our knowledge of secondary metabolites, which have already made great advances over the last decades, will make further progress in both physiological and biochemical and technological terms, confirming that their traditional placement as "secondary metabolism products" was only due to lack of knowledge.

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