Resourcing metabolome capability of horticultural and medicinal plants in designing nutraceutical and functional food crops

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It is evident that plants defend and respond precisely to environmental stresses whether biotic or abiotic. This ability of plants is relatable to their ability to synthesize an array of phytochemicals as secondary metabolites. These products of secondary metabolism represent a true reservoir of phytomolecules that have the potential to become novel curative therapeutic agents and also the nutraceuticals for preventive healthcare. The medicinal capacities of the plants used in traditional systems of medicine (like *Ayurveda, Siddha, Unani* in India) as well as in modern medicine are embedded in their genomes, which is manifested in the form of their specific metabolome. Similarly, aromas and fragrances that have evolved for the evolutionary fitness of plants, and have been recognized since long by mankind, for its sensual appeal, are also products of plant secondary metabolism.

These secondary metabolites confer the power of responding to stimuli in plants and hence the network of metabolic pathways represents the pool of functions in plant species. These pools offer various biomolecules such as alkaloids, flavanoids, terpenoids, glycosides, phenylpropanoids and the complexes of these metabolites. Most of the bioactive and / or aromatic phytomolecules are produced in very low amounts *in planta*. Therefore genomic or biochemical breeding interventions are required to engineer the metabolic pathways for the production of such phytomolecules, either in the plant itself (*designer crop*), or in heterologous systems, at a higher scale (*Bioreactors*). However, for making effective genomic interventions, the prerequisite is the complete knowledge of all the genes involved in multistep secondary metabolic pathways in plants, and this information is not available for most plant pathways currently. Logically, the initial step would be the complete elucidation of plant secondary metabolic pathways.

Among the agricultural crops beyond typical medicinal and aromatic plants (MAPs), horticultural crops provide the greatest resource of domesticated species for which agrotechnology and agronomic practices to a level of GAPs are available in addition to well-bred varieties. In fact, many of them also overlap with MAPs even if usage is for food and not medicine or aroma. While berries rule the antioxidants domain that is popularly linked to preventive healthcare, the phenyl-propanoids provide the key in many diverse species and crops covering parts from roots and rhizomes to fruits, leaves and floral usage. Terpenoids, the major group of phytochemicals with a hierarchy of mono (C10), sesqui (C15), di (C20), tri (C30) tetra(C40) and further polymeric molecules starting with C5 isoprene, the simplest in the pathway show the biosynthetic complexities as well as capabilities in plants breaking

taxonomic classification into molecular and chemotaxonomy as the path through pathways. The need of shift in agricultural research from single discipline base approach to interdisciplinary mode integrating agronomy and biology with chemistry (phytochemistry) is required. Focused attention on the quality traits for the nutritional value to build up breeding programs is the need of the hour. The shift in research strategy has to be from quantities to quality, biomass to biomolecules, chemicals to bioactives and food to nutrition and even drugs implying thereby agriculture to and for health. A revisit to the crops particularly horticultural and plantation domains is required to be addressed at biochemical level to strategically plan genomic diversity utilization with multidisciplinary approach strengthening the breeding novel genotypes that express as high value chemotypes of the nutraceutical crops. These aspects of resources including genetic variation, species, metabolic pathways and gene pools in relation to the bioactive phytomolecules for nutrition will be discussed to make a roadmap for plant metabolome research in nutraceutical crops and products of future.