

Plant secondary metabolites and its chemical classes

Carl Sagan*

Department of Plant Genecology, University of the Andes, Bogotá, Colombia

Commentary

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***For Correspondence:**

Carl Sagan, Department of Plant Genecology, University of the Andes, Bogotá, Colombia

E-mail: Carlsagan89@mail.com

DESCRIPTION

Secondary metabolites are organic compounds produced by any life form, such as bacteria, fungi, animals or plants but not directly involved in the normal growth, development or reproduction of the organism. They are also known as specialised metabolites, toxins, secondary products or natural products. Instead, they typically operate as mediators between ecological interactions which might give the organism a selection advantage by boosting its ability to survive or reproduce. Within a phylogenetic group, specific secondary metabolites are frequently confined to a small number of species. Plant defence against herbivory and other interspecies defences frequently depend heavily on secondary metabolites. Secondary metabolites are utilised by people as pharmaceuticals, flavourings, colours and medications.

Secondary metabolism frequently mediates mutualistic interactions like pollination and resource sharing as well as antagonistic interactions like competition and predation. Secondary metabolites are typically restricted to a single lineage or even species but there is strong evidence that horizontal transmission of complete pathways between species or genera played a significant role in the development of bacteria. Four distinct species of arboreal marsupial folivores responded differently to a eucalypt secondary metabolite in the same forest. This demonstrates how two ecological niches for herbivorous animals can be divided according to different types of secondary metabolites. In relation, some species have the ability to withstand secondary metabolites and even make use of them. The ability of monarch butterflies for instance to consume milkweed despite the presence of poisonous cardiac glycosides is a result of evolution. The butterflies can profit from the poisons by actively sequestering them,

which can discourage predators in addition to making them resistant to them. Primary and secondary metabolites are the two main categories of organic substances that can be produced and synthesized by plants. Secondary metabolites are metabolic intermediates or products that are formed in reaction to stress but are not necessary for the development and survival of the generating plants. Instead, they are needed for plants to interact with their environment. The plant is shielded against diseases by their antibiotic, antifungal and antiviral capabilities. Some secondary metabolic substances, such as phenylpropanoids, shield plants against UV deterioration.

Isoprene units make up the broad class of natural compounds known as terpenes. Terpenoids are oxygenated hydrocarbons, whereas terpenes are simply hydrocarbons. Terpenes generally have the chemical formula $(C_5H_8)_n$, where n is the number of connected isoprene units. Terpenes are hence also known as isoprenoid compounds. The quantity of isoprene units in their structure determines their classification. Many sterols, which are terpenoids are main metabolites. Gibberellins, brassinosteroids and strigolactones are a few terpenoids that may have been secondary metabolites before being used as plant hormones. Chemical compounds known as phenols are distinguished by the presence of aromatic rings with one or more hydroxyl groups. Phenols are the most common secondary metabolites in plants, and they include simple molecules such as phenolic acid as well as complex polymerized compounds like tannins. Alkaloids are a class of basic chemicals that contain nitrogen. They are typically derived from plant sources and contain one or more nitrogen atoms, which are extremely diverse chemically.

Alkaloids that are not heterocyclic or unusual, such as hordenine or N-methyltyramine, colchicine and taxol. Heterocyclic or common alkaloids like nicotine, caffeine and quinine. Secondary metabolite formation by bacteria begins during the stationary phase as a result of nutritional deficiency or in reaction to environmental stress. Although it is not necessary for bacterial development, secondary metabolite production enables them to interact with their ecological environment more effectively. The primary non-ribosomal, β -lactam, oligosaccharide, shikimate, polyketide and secondary metabolite synthesis pathways in bacteria are these. Mammals are poisonous to several secondary metabolites produced by bacteria. Exotoxins are harmful substances that are secreted; whereas endotoxins are substances located on the surface of the cell. The botulinum toxin produced by *Clostridium botulinum* are illustrations of a secondary metabolite produced by bacteria that can have both beneficial and harmful effects on humans. When consumed, this exotoxin frequently accumulates in improperly canned foods and disrupts cholinergic neurotransmission, resulting in death or muscle paralysis. Botulinum toxin, however, is also used for a variety of medical purposes, including the treatment of migraines, muscle stiffness and cosmetic purposes. Selective breeding was one of the first biotechnology methods for removing unwanted secondary metabolites in food, such as naringin, which makes grapefruit bitter. Sometimes the goal is to increase the amount of secondary metabolites in a plant. Traditionally, in-vitro plant tissue culture techniques were used for this, which allow for the control of growing conditions, the reduction of plant seasonality and the protection of plants from parasites and dangerous bacteria. By including elicitors like jasmonic acid, UV-B or ozone in a tissue plant culture, the synthesis of secondary metabolites can be further improved. These substances stress a plant, causing it to produce more secondary metabolites.