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The basic idea on Allelopathy

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Allelopathy is the releasing of allelopathic compounds by one plant species that inhibit the growth and development of neighboring plants of another species. Weeds, besides removing moisture and nutrients, harbor insects and diseases. Manual weed management practices are laborious and expensive. Despite herbicides being effective in increasing yield, indiscriminate use of herbicides has resulted in serious ecological implications such as the development of herbicide-resistant weeds and a shift in a weed population. Recently, research attention has been focused to find out alternative strategies for chemical weed control in several crops. Reduction in herbicide use is one of the major goals of modern agriculture and there is much emphasis in the search for alternative weed management strategies that are cheap, safe, and sustainable. Allelopathy is considered an effective, economical, and environmentally friendly weed management approach. The release of allelopathic compounds from leaves, flowers, seeds, stems, and roots of living and decomposing plant materials can influence weed density and growth.

A large number of plant and weed species produce secondary metabolites known as allelochemicals, and the process is known as allelopathy. Allelochemicals can be used to control weeds in agricultural systems by using allelopathic crops for intercropping, crop rotation, or mulching. A few important examples of crop species with high allelopathic potential may include (but are not limited to) wheat, rice, sorghum, rye, barley, and sunflower. The naturally produced allelochemicals in these crops could be manipulated to suppress weeds and witness an environment-friendly and sustainable agricultural production system.

Allelopathy is a biological phenomenon by which an organism produces one or more biochemicals that influence the growth, survival, and reproduction of other organisms. These biochemicals are known as allelochemicals and can have beneficial (positive allelopathy) or

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Detrimental (negative allelopathy) effects on the target organisms. Allelochemicals are a subset of secondary metabolites, which are not required for metabolism (i.e. growth, development, and reproduction) of the allelopathic organism. The term allelopathy or Teletoxy was introduced by Molisch (1937). Parthenium daughter plants exhibiting teletoxy to its parent plants is known as autotoxy. The word allelopathy is derived from Greek – allelo, meaning each other, and pathos, an expression of the sufferance of disease. Allelopathy is characteristic of certain plants, algae, bacteria, coral, and fungi. Allelopathic interactions are an important factor in determining species distribution and abundance within plant communities and are also thought to be important in the success of many invasive plants. Allelochemicals are found to be released to the environment in appreciable quantities via root exudates, leaf leachates, roots, and other degrading plant residues, which include a wide range of phenolic acids such as benzoic (1) and cinnamic acids (2), alkaloids (3), terpenoids (4) and others. These compounds are known to modify the growth, development of plants, including germination and early seedling growth. Allelochemicals are released in the form of Vapour (released from plants as vapor): Some weeds release volatile compounds from their leaves. Plants belonging to Labiatae, compositeae yield volatile substances. Leachates (from the foliage): From Eucalyptus allelochemicals are leached out as water toxins from the above-ground parts by the action of rain, dew, or fog.

Allelopathic compounds

The secondary products could be classified in the following categories but it is impossible to enumerate every chemical identified as allelochemicals. Rice (1984); Putnam and Tang (1986) divided allelochemicals into various major chemical groups:

- Simple water-soluble organic acids
- Simple unsaturated lactones
- Long-chain fatty acids and polyacetylenes
- Simple phenols
- Naphthoquinone, anthroquinones and complex quinones
- Flavonoids
- Benzoic acid and derivates
- Steroids

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- Cinnamic acid and derivates
- Tannins
- Amino acids and polypeptides
- Coumarins
- Sulphides and glucosides
- Purines and nucleotides
- Alkaloids and cyanohydrins
- Thiocyanates
- Lactones
- Acetogenins

Mode of allelochemicals release

The mode of transfer may play a great role in its toxicity and persistence. The donor plant which releases these chemicals, general stores in plant cells in a bound form, such as water-soluble glucoside, polymers including tannins, lignin, and salts. It has been suggested that upon cleavage by plant enzyme or environmental stress, the toxic chemicals are released into the environment from special glands on the stems or leaves.

First, the terpenoids such as α-pinene, β-pinene, cineole, and camphor are released through volatilization in the environment, which is noticeable under drought conditions. Water-borne phenolics and alkaloids are then moved out by rainfall through leaching. Scopoletin and hydroquinones may be released to the surrounding soil through root exudates.

The pool of allelochemicals in the soil is replenished by volatilization, leachates, root exudates, and decomposition of crop residues and at the same time, it is exhausted through absorption by plants, decomposition by micro-organisms, and carried away by wind and water.

In higher plants allelochemicals are released from through:-

- Vapour- from roots and leaf (from stomata)
- Stem or leaf leachate
- Root exudates
- Decomposition of plant residues

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- Seed extract

The mood of action of allelopathy affect many aspects of plant ecology, including

- Occurrence
- Growth
- Plant succession
- The structure of plant communities
- Dominance
- Diversity and plant productivity

The mode of action of a chemical can broadly be divided into a direct and an indirect action (Rizvi et al., 1992) Effects through the alternation of soil properties, nutritional status and an altered population or activity of microorganisms and nematodes represent the indirect action. The direct action involves the biochemical/physiological effects of allelochemicals on various important processes of plant growth and metabolism. Processes influenced by allelochemicals involve.