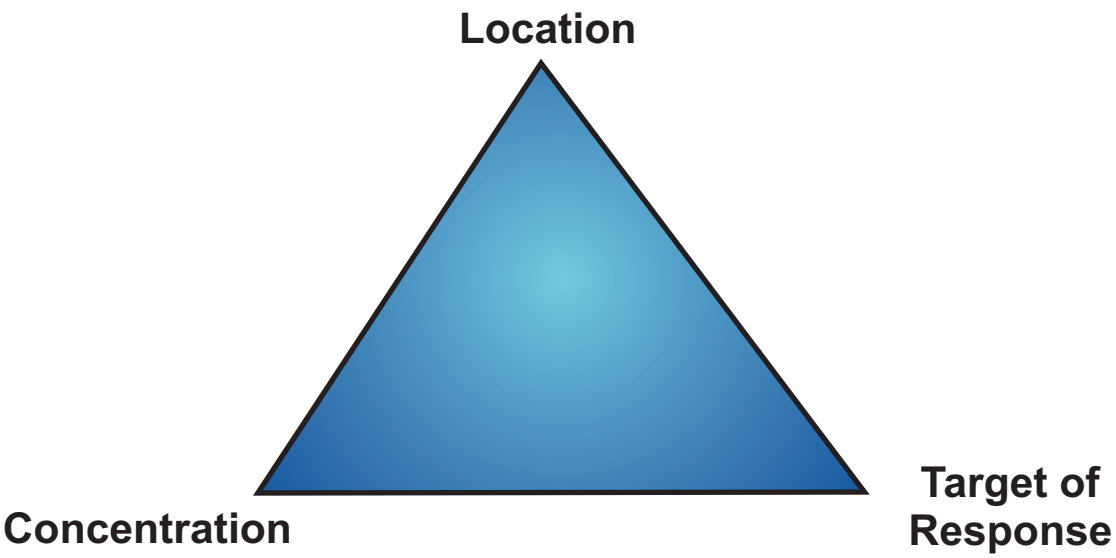
BIOLOGICALLY ACTIVE COMPOUNDS

- A compound that exerts a direct physiological effect on a plant, animal or another microorganism.

Biological activity is a result of the combined effect of

- Location
- Concentration
- Interaction of response
  - compounds
  - target organisms



ROUTES OF ENTRY INTO THE ENVIRONMENT

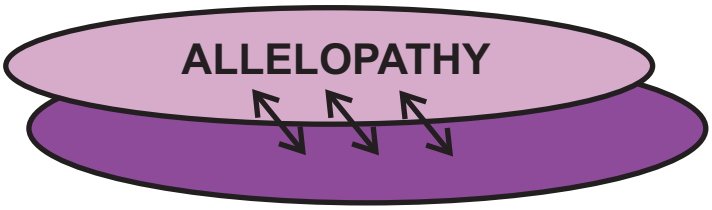
1. Root exudates
2. Decomposition products (Amygdalin)
3. Volatile toxicants (Terpenoids)
4. "Sick Soil" compounds
   (Accumulation of products from previous inhabitants)
   - Anaerobic conditions
   - Large amounts of C
   - High microbial activity
5. Wash from leaf surface
6. Man
7. Bt proteins
8. DNA

BIOLOGICALLY ACTIVE COMPOUNDS

1. Humic substances
2. Siderophores
3. Plant growth regulators
   (auxins, ethylene, etc.)
4. Allelopathics
5. Vitamins
6. Antibiotics
7. Extracellular soil enzymes
8. Microbial and soil fauna stimulants
9. Natural insecticides or herbicides

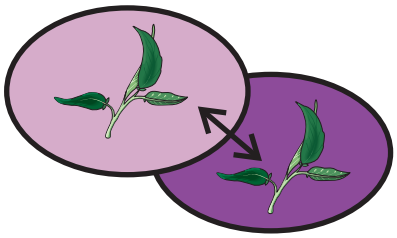
Plant	Treatment (ppm)	Growth Response (G) Shoots	Roots
Soybeans	HA (0)	2.8	0.81
	(800)	3.1	0.98
	FA (0)	2.8	0.80
	(800)	3.2	1.06
Clover	HA (0)	1.2	0.43
	(800)	1.6	0.51
	FA (0)	1.2	0.44
	(800)	1.6	0.86

1. Accelerate respiration
2. Increase cell permeabilities
3. Illicit hormonal responses

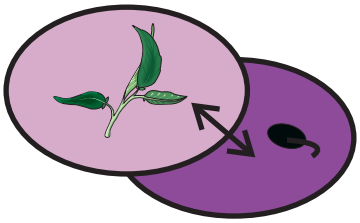


Word coined by Molish (1937) and defined as

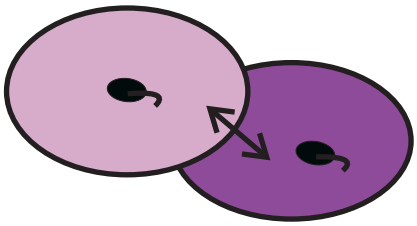
"a biochemical interaction between all types including microorganisms"



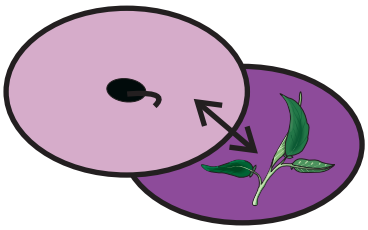
Plant on plant
Koline



Plant on microorganism
Phytonicide



Microorganism on microorganism
Antibiotic

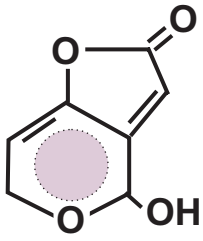


Microorganism on plant
Marasmin

ALLELOCHEMICAL AGENTS

1. Aliphatic compounds (simple organic alcohols and acids) 'soil sickness"

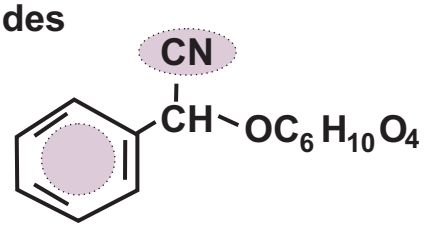
2. Unsaturated lactones
   - most studied is **Patulin** (*Penicillium* sp.)



3. Fatty acids and lipids
   - Dihydroxystearic acid

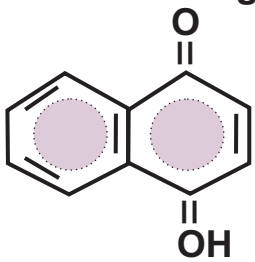
4. Cyanogen glycosides

Amygdalin

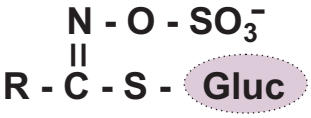


5. Terpenoids (arid or desert plants)
   - many are also volatile

6. Aromatic compounds (have a benzene ring)
   - Simple phenols
   - Phenolic acids
   - Quinones - **Juglone**
   - Tannins

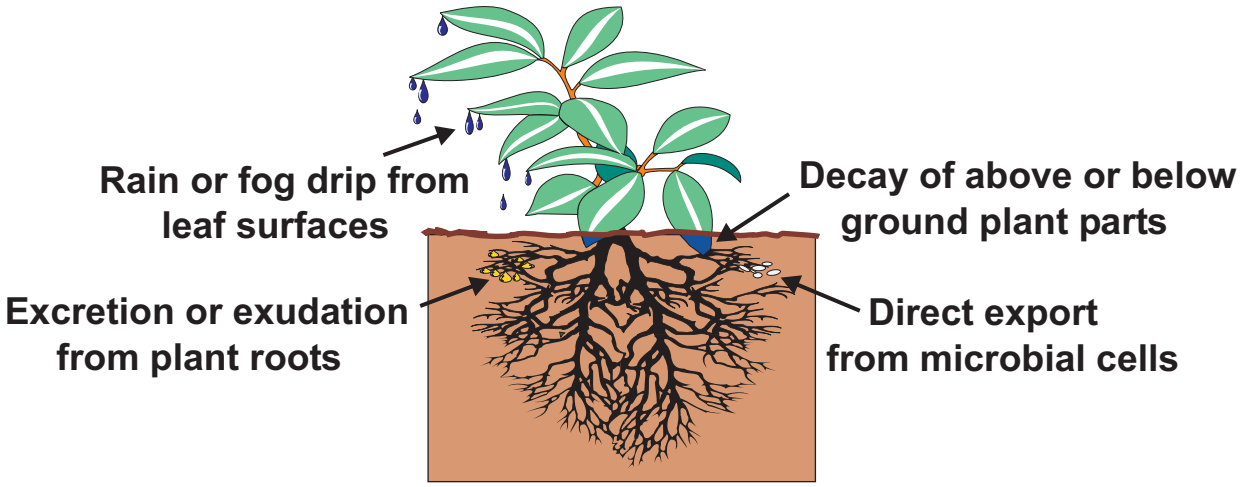


7. Glucosinolates
   - Nitriles (R-C≡N)
   - Thiocyanates (R-S-C≡N)
   - Isothiocyanates (R-N=C=S)



General Points about Allelopathy

1 Variety of Routes of Release



2 Widespread Occurrence

- Variation due only in intensity and time

3 Significant in Natural Plant Succession

4 Autotoxicity

5 Chemical Character

- Phenolic acids
- Aromatic compounds
- Terpenoid substances
- Steroids
- Alkaloids
- Organic cyanides

6 Production in Plants

- Many allelopathic compounds occur as glycosides (i.e. the substance is bound to a sugar making it innocuous in the plant)

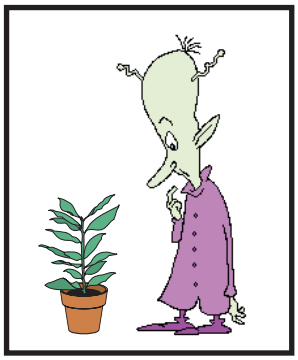
PROOF OF ALLELOPATHY
(Putnam and Tan, 1986)

1. **Demonstrate interference using suitable controls.**
2. **Isolate , characterize and assay the chemicals involved (considered key step).**
3. **Obtain toxicity with similar symptoms when chemicals are added back to the soil.**
4. **Monitor release of chemicals from the donor and detect them in the environment around the recipient.**

RESEARCH PROBLEMS

1. Degradation or chemical changes of allelopathic compounds during sampling, extraction, etc.
2. Physicochemical effects of soil
3. Interaction effects difficult to assess

PLANT RESPONSES TO PHYTOHORMONES
(Arshad and Frankenberger, 1993)



- Auxins
- Gibberellins
- Cytokinins
- Ethylene
- Abscisic Acid

Influence of Methionine (L-met) Derived C_2H_2 Produced by Soil Indiginous Microflora on Etiolated Pea Seedlings.

Treatments	Seedling Length (cm)	Seedling Diameter (mm)
Control	6.56a	1.87a
L-met (5 mM)	5.14ab	2.49b
L-met (10 mM)	3.90b	2.75c

Influence of Pisolithus tinctorius (Pt) and Tryptophan (TRP) on Growth of Douglas Fir.

Treatments	Shoot Height (cm)	Shoot Weight (g)	Root Weight (g)
Control	2.3a	3.6a	3.5a
Pt alone	2.3a	3.6a	3.6a
Pt + 10^{-4} TRP	2.5ab	3.6a	3.8ab
Pt + 10^{-6} TRP	3.6bc	4.3b	5.0c
Pt + 10^{-8} TRP	5.1c	5.1c	5.9d