

Plants are sensitive, they communicate, learn, remember...

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When a tomato plant is attacked by a caterpillar, it starts to defend itself by producing toxins. Furthermore, it sends out odours to warn other tomato plants in the neighbourhood. These in turn produce toxins. Researchers have identified the SOS alarm signals as methyl jasmonate, a substance often used in perfumes.

Odours are also part of an intricate ménage à trois between a maize plant, a caterpillar and a wasp, as demonstrated by Ted Turlings from the Swiss University of Neuchâtel: When a caterpillar attacks a maize plant, its natural enemy, a parasitoid little wasp is not far behind. It lays its eggs in the caterpillar and slowly kills it. How does the wasp know how to locate its prey so quickly?

Turlings group has discovered that maize attracts wasps by emitting a special blend of volatiles, mainly composed of indole and terpenoids. "These odours are actually so strong you can smell them too", says Turlings. But how does the maize 'know' that it is being attacked by a caterpillar? By the spit of the caterpillar. The plant tastes in the spit the chemical volicitin and then immediately begins to produce odours that attract the wasps.

A very sophisticated and flexible three-cornered relationship!

Communication among plants is common. As a scientist put it: In nature there is a constant murmur, always and everywhere, a murmur with scents.

Plants not only chat with each other, they are sensitive to at least 17 distinguishable environmental variables. The measurement of light – its quality and intensity – is crucial for many basic metabolic processes. They detect harmful ultraviolet B-rays and produce pigments which filter out these rays, as sort of an own suntan lotion. Plants are also sensitive to vibrations, chemicals, gravity, sounds or temperature. They can alter their growth, number of leaves, stem thickness as well as certain metabolic processes accordingly.

Some scientists are convinced that plants can remember, learn and plan in advance. An example: When the roots of young plants are exposed to low levels of salt or to dryness the plant will survive later in normally lethal concentrations of salt or in drought. This pre-treatment experience can last for months or years, it can also be interrupted if the conditions are reversed. The plants, say researchers, learn to deal with these conditions and will remember them later on.

Plants are even called intelligent by some researchers. The word intelligence comes from latin: Inter-legere, to choose between different options. Plants can do that. They're not just passive automats that only react to environmental changes in a pre-programmed way. Modern biology tumbled the mechanistic concepts regarding the essence of plants. Descartes' legacy should be buried once and for all.

Of course there are fundamental differences between plants and animals. Plants have no brain and they cannot run away. They do not need to; their resources are

diluted in space (light, carbon dioxide, nutrients in the soil) so they need a surface as expanded as possible (leaves, roots). Plants have a “modular” growth: They constantly add new parts and get rid of others, leaves for instance, or branches. You can cut a branch from a tree and it grows again, but you cannot tear off a cat’s leg. And, individually, each leaf looks for as much light as possible in surroundings that are constantly changing. So decisions are sooner taken on a leaf level or in the root than in the whole plant. Plants have been called democratic conglomerates or meta-populations.

The crucial point is: Both plants and animals are highly flexible and adaptive: An animal’s flexibility is evident in its behaviour. A plant’s flexibility is evident in its growth and development .

Scientists base their hypotheses of learning, remembering or intelligent plants on the striking similarities of plants and animals on the cellular level: For their internal communication plants use same and similar signalling molecules as humans. They also communicate with electrical potentials, as do our nerve-cells. New research has shown that the molecular basis for learning, as we know it in animals, can also be found in plants. And they even have an innate immune-system, very much similar to the one animals and humans have.

Many of these insights could be used for exciting new strategies in agriculture.