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Some interesting facts behind plant defence mechanisms

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In nature, plants face constant threats from a variety of predators, which come in all shapes and sizes. Threats range from not just small insects like aphids and grasshoppers, but also from microorganisms, such as fungi and viruses that compromise plant’s security. Large herbivores like cows and elephants who want to access the copious nutrients and water that a plant provides also pose a problem for them. Unlike animals, plants cannot flee the area of attack or fight off predators with teeth, claws or muscle power. But rather they are equipped with a host of internal and external defences which help them ward off their predators by turning them into a less enticing meal and in some cases even a lethal one. One such defence is exhibited by the Mimosa pudica which is a creeping annual plant, more popularly known by the names of the humble plant or shy plant, among others. It can protect itself from getting bitten by predators as it contains specialised mechanoreceptor cells which have the ability to detect touch and send an electrical signal to the plant base. This causes cells at the base to release charged particles leading to charge build-up which in turn, draws water out of the cells, making them shrivel. The folding movement resulting from shrivelling scares small insects away and pulls the leaflets closed. Other browsing herbivores also find these shrunken leaves less appealing.

Another defence mechanism is demonstrated by the tomato plant as it faces a major threat from aphids and cutworms as they slowly kill the tomato plant by sucking the juice out of its leaves. But to fight off these insects the tomato plant uses a chemical defence mechanism. When under attack, the leaves of the tomato plant release a volatile compound called (Z)-3-hexanol into the air, which is taken in by the neighbouring plants, converting it into glycoside (Z)-3-hexenyl vicianoside. This compound has been found to affect the maturation and survival rate of insects. Additionally, cotton plants show both the direct and indirect mechanisms of natural defence. In the latter, it accumulates and allocates secondary metabolites including volatile and non-volatile terpenoids like gossypol, hemigossypolone, sesquiterpenes and phenolics such as cinnamic acid when attacked by caterpillars. Whereas, in the case of the indirect mechanism, it employs volatile organic compounds (VOC) emissions, which are known to exhibit an attracting and repelling effect aimed towards the attraction of arthropod-pest enemies like larger insects and repulsion of egg-laying females like butterflies. Other notable examples include roots of cassava plant which produce cyanide from glycol cyanide on ingestion by herbivores and foxglove plants which synthesise lethal chemicals, such as cardiac and steroidal glycosides which result in convulsions, nausea and even death if ingested by animals. Thus, plants have evolved various morphological, biochemical and molecular mechanisms to defend themselves against predators.

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