Signaling and Communication in Plants

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Plant Communication from an Ecological Perspective

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Preface

Since the concept of allelopathy was introduced almost 100 years ago, research has led to an understanding that plants are involved in complex communicative interactions. They use a battery of different signals that convey plant-relevant information within plant individuals as well as between plants of the same species or different species. The 13 chapters of this volume discuss all these topics from an ecological perspective. Communication between plants allows them to share physiological and ecological information relevant for their survival and fitness. It is obvious that in these very early days of ecological plant communication research we are illuminating only the 'tip of iceberg' of the communicative nature of higher plants. Nevertheless, knowledge on the identity and informative value of volatiles used by plants for communication is increasing with breath-taking speed. Among the most spectacular examples are situations where plant emitters warn neighbours about a danger, increasing their innate immunity, or when herbivore-attacked plants attract the enemies of the herbivores ('cry for help' and 'plant bodyguards' concepts). It is becoming obvious that plants use not only volatile signals but also diverse water soluble molecules, in the case of plant roots, to safeguard their evolutionary success and accomplish self/non-self kin recognition. Importantly, as with all the examples of biocommunication, irrespective of whether signals and signs are transmitted via physical or chemical pathways, plant communication is a rule-governed and sign-mediated process.

The previous volumes focused on signalling molecules and pathways, as well as on communication related to plant sensory biology underlying the emerging concept of plant behaviour. Here, individual chapters deal with diverse aspects of plant communication such as evolution of plant signals and toxins, chemical signals in plant photobiology and 'arms-races' in pathogen defence, allelopathy of exotic plant invasion, volatile chemical interactions between undamaged plants and their effects at higher trophic levels, chemical communication in plant–ant symbioses, as well as effects of global atmospheric changes on plants and their trophic interactions. Finally, two chapters deal with the perspective of exploiting the chemical signals of plant communication for sustainable agriculture, and the technological

possibility of monitoring plant volatile signals to obtain information about plant health status in greenhouses.

For many years, plants were placed outside of the communicative and even the sensitive living domain. Immanuel Kant even went so far as to place plants outside the living realm. The vocal-based physical (acoustic) language of humans depends on air vibrations that are decoded in the ears. The volatile-based chemical language of plants is communicated by volatiles decoded via diverse receptors (most of them still unknown). Plants are unique and differ greatly from animals. This makes it very difficult for us, biassed by the human-centric perspective of our world-view, to grasp their whole communicative complexity and to understand the true nature of their communications. The sessile nature of plants and the dual character of plant bodies, with the above-ground autotrophic shoots and the below-ground heterotrophic roots, are further phenomena obscuring the real nature of plant communication. In science, one should try to keep a neutral unbiased position and not exclude any possibility. We can look forward to witnessing the next wave of surprising discoveries.

Bonn, April 2010 František Baluška
Uppsala, April 2010 Velemir Ninkovic

Further Reading

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