PLANT PHYSIOLOGY: YESTERDAY, TODAY AND WHAT WILL BRING TOMORROW?

Summary

In this paper, the history of plant physiology is shortly reviewed with the main emphasis put on a limited number of subjectively chosen developments connected for the most part with the application of new noninvasive experimental methods. Since the turn of XIX and XX centuries, multidisciplinary studies towards understanding of the mechanisms of regulation and coordination of life processes at various level of organization: genetic, molecular and organismal become dominant allowing for more and more holistic description of plant functioning. The coordination of particular processes as a response to internal and external signals is one of the better understood key problems discussed in this review. In these processes important pleiotropic role is played by phytohormones which cross-talk with one another and cooperate with other regulators like nitrogen monoxide and reactive oxygen species (ROS). Next, a central and new area of research in biology, namely the process of proteins ubiquitination, is the matter at issue. Targeting of proteins for degradation with the use of ubiquitin proteasome system underlies the mechanism of degradation of denatured or nonfunctional proteins. Another discussed problem is the necessity of global crop improvement connected with an increase in photosynthetic activity and reduction of photorespiration. Special attention is paid to the function of plant phloem and ksylem systems in translocation and distribution of products of photosynthesis and nutrients, and a great number of signaling substances. The role of phloem is presented as “superhigway of information”. Integration of these processes is discussed in connection with possible improvement of crop yield. The necessity of further studies directed towards increase in plant crop, resistance of plants to environmental stress and suppression of global threats linked to environmental pollution is underlined. Finally, emergence of few new disciplines like plant neurobiology, system biology and synthetic biology is noted.