46.)

Chapter 13

Methods for Xylem Sap Collection

M. Alexou and A.D. Peuke

Abstract

Xylem and phloem are essential for the exchange of solutes and signals among organs of land plants. The synergy of both enables the transport and ultimately the partitioning of water, nutrients, metabolic products and signals among the organs of plants. The collection and analysis of xylem sap allow at least qualitative assumptions about bulk transport in the transpiration stream. For quantification of element-, ion-, and compound-flow, the additional estimation of volume flow is necessary. In this chapter we describe methods for collecting xylem sap by (1) root pressure exudate, (2) Scholander-Hammel pressure vessel, (3) root pressurizing method according to Passioura, and (4) (hand/battery) vacuum pump.

Key words: Xylem sap, Root pressure, Scholander-Hammel pressure vessel, "Passioura vessel"

1. Introduction

One of the most important and characteristic features of higher plants is their adaptation to life on land via the evolution of long distance transport systems. The requirement of long distance transport is fulfilled by phloem and xylem in cormophytes, which enable the transport of water, nutrients, and signals among the organs of plants (1). In the xylem water, minerals, products from root metabolism, and signals are transported from the root to transpiring parts of the shoot, particularly the photosynthetically active leaves. Large and especially tall plants must exhibit special features in their xylem. For example, tall trees (up to 100 m in height) must overcome significant gravitational forces in order to lift transport saps to the top of the tree.

The current view of the driving forces of long distance transport is based on gradients in the transport systems, i.e., gradients in hydrostatic pressure, water potential, and chemical potential. Gas exchange (water vapor, CO_2, O_2) and associated processes are central factors in regulating the long distance transport.

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