Portable Device for the Extraction of Xylem Sap from Trees

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ABSTRACT

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A simple apparatus was developed that provides an inexpensive, rapid, and highly portable method for collecting sizable amounts of xylem sap from trees at various times of the year. The system consists of a hand vacuum pump attached to an Erlenmeyer flask and to the tree with plastic tubing and connectors.

Xylem sap from trees has been used experimentally as a growth medium for xylem-invading organisms and in nutritional studies relating to disease susceptibility in trees. There have been various extraction techniques used, but some are cumbersome or collect very small amounts of experimental material (1–4). The apparatus being reported was developed to provide an inexpensive, simple, rapid, and highly portable method for collecting large amounts of xylem sap from trees in a forest environment at different times of the year.

Figure 1 is a picture of the apparatus. Using a hand brace and bit, one bores a hole 0.6 cm wide by 5 cm deep in the tree selected. The hole is bored 15–45 cm above the soil line, preferably above a major root, to obtain the most rapid sap flow. A plastic tubing connector is tapped into the hole, and the collection apparatus is then attached. The collection apparatus consists of a 250-ml Erlenmeyer flask sealed with a rubber stopper fitted with two glass tubes. Lengths of flexible plastic tubing are attached to both glass tubes. One length of plastic tubing leads to the bored hole in the tree and the other to a vacuum source. The vacuum source is produced by a Nalgene Mityvac hand vacuum pump (Nalgene Co., Rochester, NY 14602). A vacuum of 620 mm of

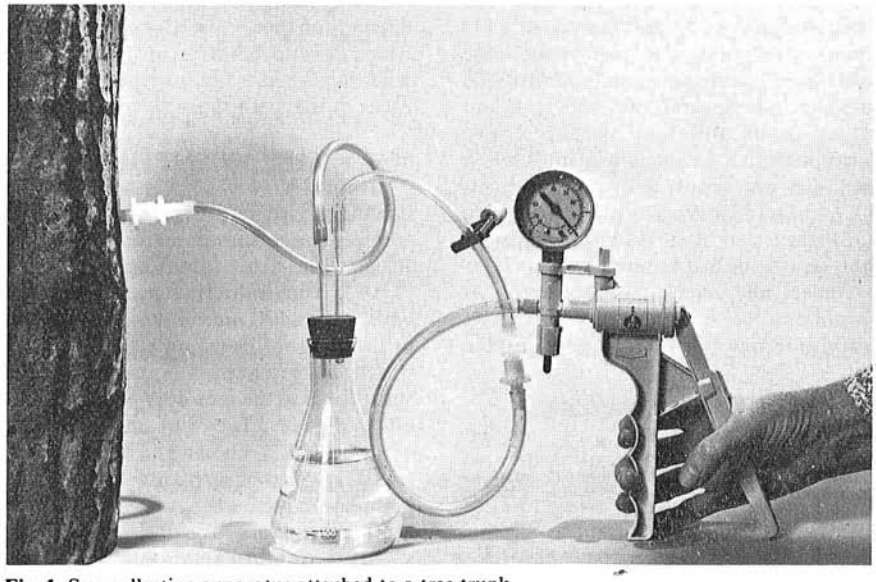

Fig. 1. Sap-collecting apparatus attached to a tree trunk.

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mercury is developed in the system at extraction time. When the optimum vacuum is attained, a C-clamp can be closed and the pump removed.

Sap was collected from five maple species—*Acer platanoides* L. (Norway), *A. saccharinum* L. (silver), *A. saccharum* Marsh. (sugar), *A. rubrum* L. (red), and *A. negundo* L. (box elder)—growing in a naturally seeded hardwood forest. The sap was used as a growth medium for *Verticillium* spp. in laboratory experiments. Collections were taken over a 2-yr period during dormancy, bud swell, budbreak, and early full-leaf stages of the trees; 750 ml of sap was collected at each sampling and packed in ice for later use in the laboratory. In general, 250–300 ml of sap could be extracted under vacuum in 15 min from trees during the dormant and bud-swell stages. Extraction rates were about 25% less at the budbreak stage and 66% less at early full-leaf stage. Sap was generally extracted more rapidly from sugar and Norway than from the other maple species.

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