

- 1) How is the downhill concentration gradient of sucrose through the mesophyll cells and into the phloem apoplast maintained?
- 2) Will the pH in the phloem cells be higher or lower than in the phloem apoplast?
- 3) Below is a picture of an aphid “sucking” on the phloem. Is it really sucking?



An aphid sucking phloem. The stylet of this aphid, on the underside of a branch of basswood, has penetrated the bark to reach the phloem in a sieve element.

- 4) Two important characteristics of the phloem are that it transports specific sugars (sucrose in many species and a number of other sugars and sugar alcohols in others), and that the sugars are very concentrated. Explain both characteristics in terms of phloem loading.

Answers:

- 1) Sucrose is continually being made in the mesophyll cells. Active transport keeps the concentration of sucrose low in the phloem apoplast.
- 2) Higher. The pH of the phloem sap and apoplast are about 8.5 and 5.5, respectively.
- 3) No. There is lots of pressure in the phloem, and it pushes the sap through the aphid. If the stylet is severed (tiny laser beams are used), the sap continues to flow out of the cut end.
- 4) Specificity for certain sugars is conferred by sugar-proton cotransport proteins; these transporters have substrate specificity just as enzymes do. Active transport from the apoplast to the inside of the phloem cells explains the high concentration of sugar.