A FACILITATED GLUCOSE/FRUCTOSE TRANSPORTER OF THE PHLOEM-SAP FEEDING INSECT, THE BROWN PLANTHOPPER, *NILAPARVATA LUGENS*

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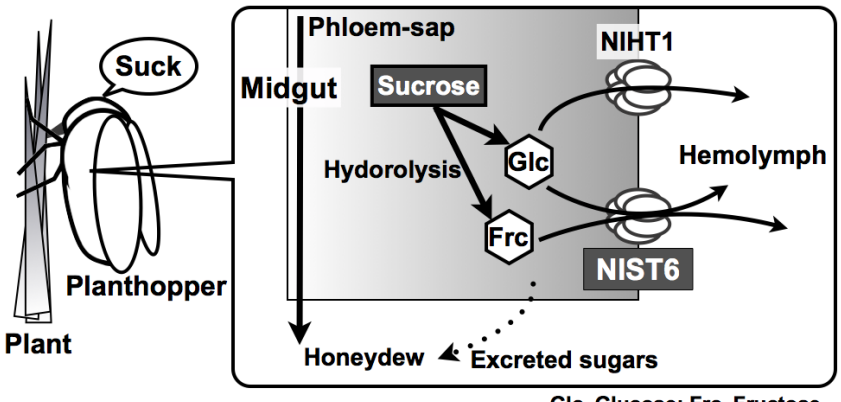
The brown planthopper (BPH), *Nilaparvata lugens*, attacks rice plants and sucks their phloem-sap, which contains large amounts of sugars. The main sugar component of the phloem-sap is sucrose, a disaccharide composed of glucose and fructose. Sugars hydrolyzed to monosaccharides appear to be incorporated into the planthopper body across the sugar transporters in the midgut. Recently, a facilitated glucose transporter gene expressed in the midgut, *NlHT1*, has been identified in BPH (Price et al., 2007). NlHT1 did not function for fructose uptake, therefore, sugar transporter for fructose uptake remains unknown in planthoppers. A total of 93 expressed sequence tags (ESTs) for putative sugar transporter genes were obtained from a BPH cDNA EST database (http://bphest.dna.affrc.go.jp/), and 18 putative sugar transporter genes (*Nlst1-18*) were identified. The most abundantly expressed gene was *NlHT1 (Nlst1)*. *Nlst1, 4, 6, 9, 12, 16*, and *18* were highly expressed in the midgut. It is difficult to identify substrates of sugar transporters based on their primary amino acid sequences. Therefore, the functional analyses of NlSTs were performed using the *Xenopus* oocyte expression system. This showed that NlST6 was a facilitative glucose/fructose transporter that mediates sugar uptake from rice phloem-sap in the BPH midgut in a manner similar to NlST1. Kinetic analyses revealed that NlST6 was more effective for fructose transport than for glucose transport. The facilitative sugar transporter move sugars along gradients from regions of high concentration to those of lower concentration. BPH obtains sugars as a nutrient sources from the phloem-sap and carries them to the hemolymph by driven gradients across the transporter. This is the first report of the identification of the transporter responsible for incorporating fructose in planthoppers.



Sugar flow in planthopper.
Sucrose in rice phloem-sap is hydrolyzed into glucose and fructose in the midgut. NlST6 transported the glucose and fructose into the hemolymph.