

XYLEM NUTRIENT UTILIZATION AND THE LIFE HISTORY OF SHARPSHOOTER LEAFHOPPERS

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Our knowledge of how insects subsist on the dilute nutrients in xylem fluid has greatly increased, yet comparatively few studies have addressed the stages of life history when insects are most likely to be nutritionally constrained (immature development and egg production). Historically, the sharpshooter *Homalodisca vitripennis* Germar (Hemiptera:Cicadellidae) were difficult to rear on single host species; many of the common hosts for adult leafhoppers were insufficient for nymph development. In a series of experiments, we found suitable developmental hosts and identified the nutritional requirements for *H. vitripennis* development. Nutrients required for development varied greatly from nutrients preferred by adults. Whereas adults prefer to feed (high consumption rates and high adult abundance) on plants with high concentrations of amides in xylem fluid, nymph performance (survival, growth rates, developmental period) was greater on hosts with more 'balanced' amino acid profiles containing higher concentrations of 'essential amino acids' (those that most insects cannot synthesize). This disconnect between adult feeding preference and developmental requirements led us to test the 'Mother Knows Best' or 'Preference-Performance' hypothesis; do *H. vitripennis* preferentially oviposit on hosts where immatures will have high performance? In choice and no-choice tests using a wide variety of hosts, we found no relationship of oviposition preference with success in immature development. Xylem analyses for hosts utilized in the experiments confirmed the relationship between essential amino acids and nymph performance. Surprisingly, rates of ingested essential amino acids were also the best correlates to aspects of adult performance. We further tested the effects of xylem nutrients on both *H. vitripennis* behavior (host selection and consumption rates) and adult performance (survival, body weight gain and oviposition) in the field using a variety of *Prunus* germplasm at different times of the year. Nutrients mediated both behavior and performance, but different nutrients regulated behavior as compared to adult performance. Host selection was highly plastic as host preferences changed with season. However, glutamine was a consistent correlate to consumption rates and adult abundance throughout the experimental period. Rates of ingested essential amino acids were most tightly correlated to adult performance, but a sharp demarcation in allocations to life history parameters occurred seasonally with ingested nutrients being correlated to body mass gain early in the season and to fecundity rates six weeks later when *H. vitripennis* is at seasonal peaks. Further research is needed to elucidate if these changes in nutrient allocation are solely mediated by nutrient levels or by other abiotic or biotic factors. Insects that feed on xylem fluid ingest a nutritional source depauperate in organic nitrogen and carbon. Our experiments suggest that consideration of nitrogen form is equally important in order to understand nutrient utilization throughout the life cycle of sharpshooter leafhoppers.