A COMPARISON BETWEEN THE SALIVARY PHYSIOLOGY OF THE CRUSADER BUG, *Mictis profana* Fabricius (COREIDAE) AND THE GREEN LUCERNE MIRID, *Creontiades dilutus* (Stål)

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May 1995

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SUMMARY

The saliva of phytophagous Heteroptera, secreted into plant substrates during feeding, is implicated in the etiology of the often characteristic lesions produced by these insects. Similarities in salivary components within Heteropteran families allow for comparisons and conclusions drawn on any one representative species to be extended to other species of the same family. In this context, the salivary physiology of *Mictis profana* Fabricius (Coreidae) and *Creontiades dilutus* (Stål) (Miridae), representatives of two significantly important families of the Heteroptera, is investigated.

Feeding by *M. profana* causes initial water soaked lesions, followed by a concurrent increase in water content at the feed site, and acropetal terminal wilting of small diameter shoots of the host plant. Cells in the vicinity of the vascular bundles are selectively targeted by branches of the stylet tracks. Successive feeding punctures, indicated externally by the presence of stylet sheath flanges, occur at intervals of about 0.3 mm invariably in a basipetal direction. It is postulated that this successive basipetal adjustment of feed sites is necessary for the insect to counter the advancing tip senescence.

The posterior lobe contributes sucrase (sucrose α-D-glucohydrolase, EC 3.2.1.48) as the only carbohydrase in the watery saliva. The salivary sucrase was found to have a pH optimum of 7.25, with molecular weight (MW) ca 66,000, and exhibited weak maltase activity. It appeared in the saliva in variable dilution (recorded activities were from 0.002 to 0.01 Units/μl), consistent with a moderately diluting function by the structurally undifferentiated accessory gland. The only other enzyme secreted in the watery saliva was a catechol oxidase derived from the accessory gland. Given that sugars are not a limiting dietary resource it is postulated that the salivary sucrase, localised within the food plant by stylet sheath, induces a strong osmotic gradient by the conversion of endogenous sucrose to glucose and fructose, thus creating a general flow of nutrients to the region from which the insect is imbibing. This is supported by a concurrent increase of detectable amino nitrogen at the feed site. In attempts to simulate this process in pressure bomb experiments, infiltration of glucose and fructose, stoichiometrically equivalent to 0.5 M sucrose *via* a cut end of a lucerne, *Medicago sativa* L. shoot caused an increase in both the quantity and the amino acid content of tissue sap over that extractable by 0.5 M sucrose alone.

The feed site of *M. profana* is clearly a sink site, where phloem unloading of solutes actively takes place (previous work on phloem transport, while still to some extent controversial, has indicated the importance of sugars and plant invertases as a

stimulus for phloem unloading). The insect destroys the acropetal meristematic sink (its competitor), possibly by the sheer volume of liquids removed and certainly by causing acropetal necrosis. This may well be promoted by the secretion of salivary oxidases which should be capable of inducing a general 'leakiness' to plant cell membranes. At the same time, the insect creates a local stimulus that elicits phloem unloading presumably by elevating monosaccharides by action of the salivary sucrase. This, effectively is an enzymic mimic of the plants own invertase. The term "osmotic pump feeding" is proposed for such a process.

Like *M. profana*, *C. dilutus* causes water soaked lesions around the feed site. It feeds preferentially on the flower racemes and seed heads, a food source apparently obligatory for juvenile survival. Abscission of the flower buds and seed pods occurs with remarkably few feeding punctures.

Both a pectinase (endopolygalacturonase, EC 3.2.1.15) and an amylase were detected in the salivary glands of *C. dilutus*. The MW of the pectinase band was estimated at 105,000. In the salivary glands its presence was restricted to the posterior lobe. As with *M. profana*, a catechol oxidase was secreted into artificial agar diets and was detected from the accessory gland. Fundamentally distinct from the coreid, however, is absence from the feeding punctures of *C. dilutus* of any recognisable stylet sheath. In addition, almost certainly relevant to its feeding strategy, is the presence of a vesicular reservoir on the accessory gland. The lack of a functional stylet sheath would undoubtedly assist in the ability of the salivary pectinase to infiltrate plant tissues, and with enzymic maceration of the intercellular pectic matrix, allow pockets of cells, beyond the reach of the stylets, to be made available to the feeding bug. This is consistent with the need for large volumes of watery saliva (readily available from the accessory gland reservoir) which could be secreted then reingested during feeding. Although there is no reason to believe that pectic substances subserve a specific nutritional requirement for the mirid, there was a demonstrable release of bound proteins, neutral polysaccharides and other plant chemicals when stem sections were incubated in pectinase.