

Evidence that Two Species of Aphid Ingest Food through an Open Stylet Sheath

Aphids secrete around their stylets a proteinaceous tube of salivary origin, the 'stylet sheath', when they penetrate substrates. The function of the sheath is uncertain; but it is of interest in relation to the transmission by aphids of stylet-borne¹ plant-viruses, since specificities in the vector-virus relationship may be explicable, once details of the feeding process are better known². It has been stated that the stylet sheath of *Myzus persicae* (Sulzer) completely encloses the stylets^{3,4} and that it may act as a filter, preventing the ingestion of particles including bacteria and possibly some viruses³. But it is difficult to reconcile a closed stylet sheath with the rapid uptake of plant sap by some species of aphids^{5,6}. Aphids will probe through a 'Parafilm M'® membrane into liquids⁷, and *M. persicae* produces sheaths when it feeds through such a membrane on sucrose and other solutions⁸. The observations described below indicate that when *M. persicae* and *Acyrtosiphon pisum* (Harris) feed on solutions through parafilm, they can, in fact, ingest particles through the open end of the stylet sheath.

When *M. persicae* apterae were given access overnight to a suspension of carbon particles (derived from Chinese stick ink) in a sucrose solution covered by stretched parafilm, the particles were taken up into the stomach. When the suspended particles were separated for size on a sucrose density gradient (0 to 60% by eight steps), *M. persicae* took up particles from those fractions up to and including the one containing particles of an average diameter of 0.5 to 1 μ . Particles recovered from the midgut were of corresponding size, even though the average diameter of the food canal of the stylet bundle was itself less than 1 μ .

During experiments by two of us (D.L. McL. and M.G. K.) on the electrical recording of events during the probing process of *A. pisum*⁹, detailed visual observations were made of the formation of the stylet sheath and the activity of the stylets. When the aphids had fasted for 1 h and fed through parafilm on a brei of bean (*Vicia faba* L.) tissue, the stylet bundle was very occasionally seen to project several tens of microns beyond the end of the stylet sheath. When aphids that had fasted about 20 h fed on sucrose solutions containing suspended carbon particles, the particles could be seen to stream into the stylet food-canal, while the tip of the stylet bundle remained level with the end of the sheath or projected a few microns beyond it. During ingestion, the sheath and stylets remained motionless. When a large carbon particle blocked the entrance to the food canal at the tip of the stylet bundle, the mandibular stylets began a piston-like

motion in an apparent attempt to dislodge the particle. In many instances this result was achieved, and ingestion then continued. When the particle was not removed, however, the aphids would begin to extend the sheath and, during this process, the issuing sheath material usually engulfed the particle and embedded it in the newly formed section of sheath: sometimes the stylets would first be withdrawn part way, and a side branch of the sheath would then be formed.

It may be objected that our observations, made under artificial conditions, do not apply to the normal feeding process on plant hosts. Nevertheless, our experimental conditions were similar to those under which both *M. persicae* and *A. pisum* will feed and grow^{10,11}, and we consider that ingestion through an open sheath is therefore probable under natural conditions as well.

Zusammenfassung. *Myzus persicae* und *Acyrtosiphon pisum* nehmen beim Saugen an Saccharoselösungen Kohlenstoffteilchen bis zu einem Durchmesser von 0,5–1 μ auf (ungefähre Weite des Nahrungskanals der Stechborsten). Demnach muss die um die Stechborsten ausgebildete Speichelscheide am Ende offen sein. Bei *A. pisum* konnte beobachtet werden, dass grössere Kohlenstoffteilchen an der Stechborstenspitze das Saugen deutlich behindern, was durch Bewegungen der Stechborsten und erneute Speichelabgabe behoben werden konnte.

P. W. MILES¹², D. L. McLEAN,
and M. G. KINSEY

Department of Entomology and Parasitology, University of California, Berkeley and Department of Entomology, University of California, Davis (USA), June 3, 1964.

- ¹ R. H. E. BRADLEY and R. Y. GANONG, *Canad. J. Microbiol.* **1**, 775 (1955).
- ² E. S. SYLVESTER, in *Biological Transmission of Disease Agents* (Ed. K. MARAMOROSCH; Acad. Press, New York 1962), p. 11.
- ³ K. S. SUKHOV, *C.R. Acad. Sci.* **42**, 226 (1944).
- ⁴ R. H. E. BRADLEY, *Ann. appl. Biol.* **39**, 78 (1952).
- ⁵ T. E. MITTLER, *J. exp. Biol.* **34**, 334 (1957).
- ⁶ M. F. DAY and H. IRZYKIEWICZ, *Aust. J. biol. Sci.* **6**, 98 (1953).
- ⁷ R. H. E. BRADLEY, *Virology* **8**, 308 (1959).
- ⁸ T. E. MITTLER and R. H. DADD, *J. Ins. Physiol.* **9**, 623 (1963).
- ⁹ D. L. McLEAN and M. G. KINSEY, *Nature, Lond.* **202**, 1358 (1964).
- ¹⁰ T. E. MITTLER and R. H. DADD, *J. Ins. Physiol.* **9**, 741 (1963).
- ¹¹ J. L. AUCLAIR and J. J. CARTIER, *Science* **142**, 1068 (1963).
- ¹² The contribution of this author was made while on sabbatical leave from the Waite Institute, University of Adelaide (South Australia), and supported in part by Public Health Service Training Grant No. 5T1-AI-218, from the National Institute of Allergy and Infectious Diseases (USA).

Neue lokalanästhetisch wirksame Analoga des Dipiperons

In vorangehender Mitteilung¹ wurde eine Reihe lokalanästhetisch wirksamer Mono- und Diester von alkoxy-substituierten Carbanilsäuren und 1-Piperidino-2,3-propanediol, welche vom Dipiperon (Diothan®) abgeleitet wurden, beschrieben. Zur Vertiefung der Beziehungen zwischen Struktur und pharmakologischen Eigenschaften haben wir einige Verbindungen synthetisiert, die von dem

bisher als besonders vorteilhaft geltenden Präparat¹ Hydrochlorid des 1-Piperidino-2-hydroxy-3-propylesters der 3-Butoxycarbanilsäure (K 103) (durch Vergrößerung der Alkoxygruppe oder Ersatz des Piperidinrückstandes durch die Dialkylaminogruppe) abgeleitet wurden. Zu letzterer Abänderung führte die Tatsache, dass in manchen Fällen Dialkylaminoverbindungen eine geringere

¹ R. DOFEK und Č. VRBA, *Arch. Pharm.* **292**, 44 (1959).