Catchpole, Roger. Department of Biology, University of Leeds, Leeds, LS2 9JT. Email: r.d.j.catchpole@leeds.ac.uk The effect of substrate hardness on penetration resistance.

This study provides an outline of the methodology for the measurement of penetration resistance in *Drosophila* oviposition substrates. Although the method was applied to standard laboratory medium (Shorrocks, 1971), it can potentially be applied to any substrate that is commonly found in the field. The preferential utilisation of different substrates by *Drosophila* has been noted for some time (Begon, 1982). Clearly oviposition sites will differ in hardness not only because of intrinsic differences in the substrate type but also because of environmental factors such as moisture content. It may, therefore, be of some interest to relate differences in hardness between different substrates to the oviposition behaviour of particular species. In another paper in this volume, Catchpole (1997) showed clear and persistent choices between different concentrations of agar even when these differences were extremely small. In order to determine whether these differences produced a physical effect, the resistance to penetration was measured using a force transducer in an attempt to simulate the insertion of an ovipositor in the substrate surface. This method has potentially wider applications in co-evolutionary studies where the ovipositor sizes of a number of different species could be related to the penetration resistance of their preferred oviposition substrates.

Table 1. Penetration resistance in four different concentrations of agar. One way ranked ANOVA with a Bonferroni *post-hoc* comparison. Values that are underlined are not significantly different from each other when p = 0.05.

Source	df	SS	MS	F	p
between	3	119606	39868	209.03	<0.001
within	116	22125	190		
total	119	141731			

0.01g/ml 0.02g/ml 0.03g/ml, 0.04g/ml

Resistance was measured by mounting an entomological pin on a force transducer as previously mentioned. The force transducer converted the mechanical force to an electrical signal which was then measured using an oscilloscope. Attempts to mount an ovipositor failed as there was no reliable way of attaching the structure to the transducer arm.

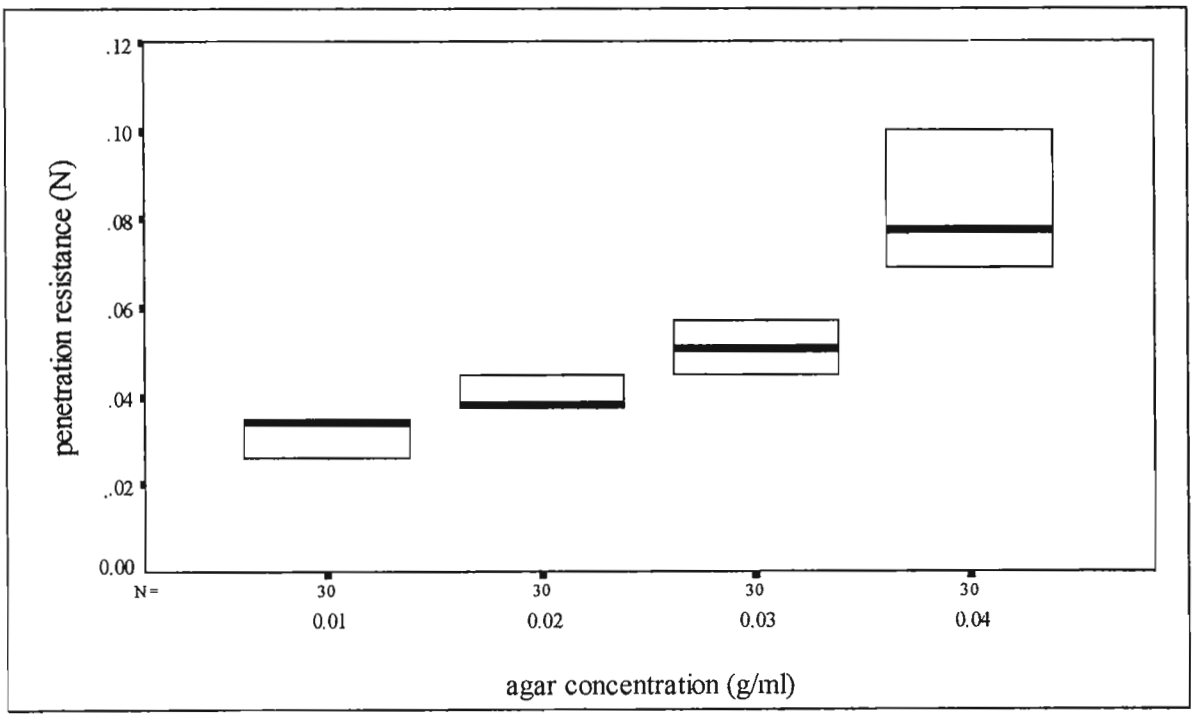

Figure 1. Penetration resistance in four different concentrations of agar. Graph shows median values and the interquartile range.

Although a pin of similar dimensions and shape to an ovipositor was used, the measurements were not intended to be a wholly realistic simulation of ovipositor insertion but simply a relative assessment of the forces involved. The electrical signal was recorded on an oscilloscope (Gould DSO 1602) and the resulting traces were measured and converted into Newtons (N) for analysis. Measurements were made on 30 separate samples of food at four different agar concentrations of 0.01g/ml, 0.02g/ml, 0.03g/ml and 0.04g/ml. This was done by dropping the mounted pin from a standard height of 3mm into each sample. The samples consisted of a standard amount of food held in a small nylon test tube cap. Separate caps were used for each measurement to avoid any influence from previous inser-tions.

Even though the differences in agar concentration were small, these were sufficient to produce clear physical differences, as can be seen from Table 1 and Figure 1. Results that were not significantly different from each other were underlined in Table 1. The larger variation in measurement at the highest concentration, shown in Figure 1, may have been due to differences in food preparation. All other concentrations were derived from a single batch while the highest concentration contained some samples from a second batch of food. In species with small ovipositors these physical differences could lead to a substantial increase in energetic costs either through the physical effort required to insert the ovipositor plates into the harder substrate or through the location of more suitable sites. Smaller species will also pay an additional penalty at the larval stage because of the increased cost of burrowing within harder substrates. In summary, clear physical differences were present between food media containing only small alterations in agar content. These differences were easily measured using a method that could be applied to a much wider range of substrates.

References: Begon, M., 1982, Yeasts and *Drosophila*. In: *The Genetics and Biology of Drosophila* 3b (ed. M. Ashburner, H.L. Carson, and J.N. Thompson, jr.) 345-384, Academic Press; Shorrocks, B., 1971, Dros. Inf. Serv. 46: 149.

Request for Assistance

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I am interested in obtaining the following wild type and mutant strains. I appreciate your help in locating any of them. Thank you.

Gruta
Falsterbo
Formosa
Stromsvreten 10
turnipe (any allele)