The influence of osmotic pressure on the hatching of *Heterodera schachtii*

Roland N. Perry, A. John Clarke and Judy Hennessy

Nematology Department, Rothamsted Experimental Station, Harpenden, Herts., AL5 2JQ, England.

Summary

When free second-stage juveniles of *Heterodera schachtii* were transferred from distilled water to concentrations of trehalose or sucrose greater than 0.1M they lost water. In solutions of about 0.3M the water content became constant at 69 %, the value obtained from unhatched juveniles in eggs equilibrated with water. Compared with juveniles in water, the number of juveniles moving in a range of concentrations of sucrose and inositol did not substantially decrease, unless the concentration was 0.5M or greater. The hatch of juveniles from cysts in 0.3M sucrose and inositol in 2mM picric acid was similar to that in distilled water, whereas a 0.6M solution completely inhibited hatching. These findings are compared with those obtained for *Globodera rostochiensis* (Clarke, Perry & Hennessy, 1978) and

Materials and methods

Cysts of *H. schachtii* were raised on pot-grown sugar-beet plants and extracted by usual methods (Shepherd, 1970). Juveniles were hatched in 2mM picric acid, collected 3 days later, washed three times in distilled water and used after storage for a day in distilled water.

For all experiments, test solutions were prepared as outlined by Clarke, Perry and Hennessy (1978). To test the effects of solutions

The relationship between osmotic pressure and movement of juveniles was examined using freshly prepared suspensions (about 50-60,000 juveniles) in different concentrations of sucrose and inositol (volume, 10 cm^3) in tubes (17.5 × 3 cm) sealed with Parafilm. Samples containing 200 to 400 juveniles were removed at intervals (Fig. 2) and the numbers moving and stationary were counted. After 8 days samples were removed, diluted ten-fold with distilled water and further counts were made after 6 and

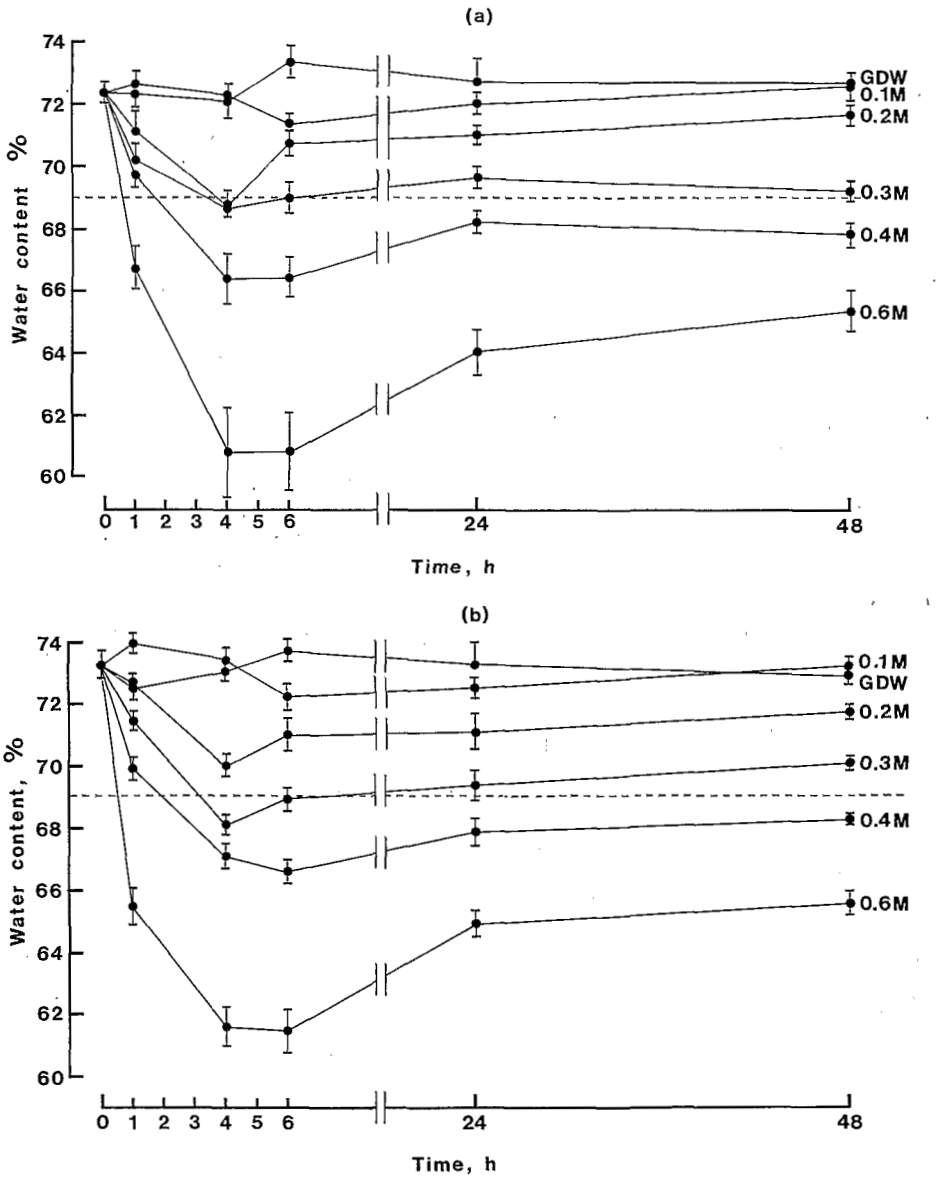
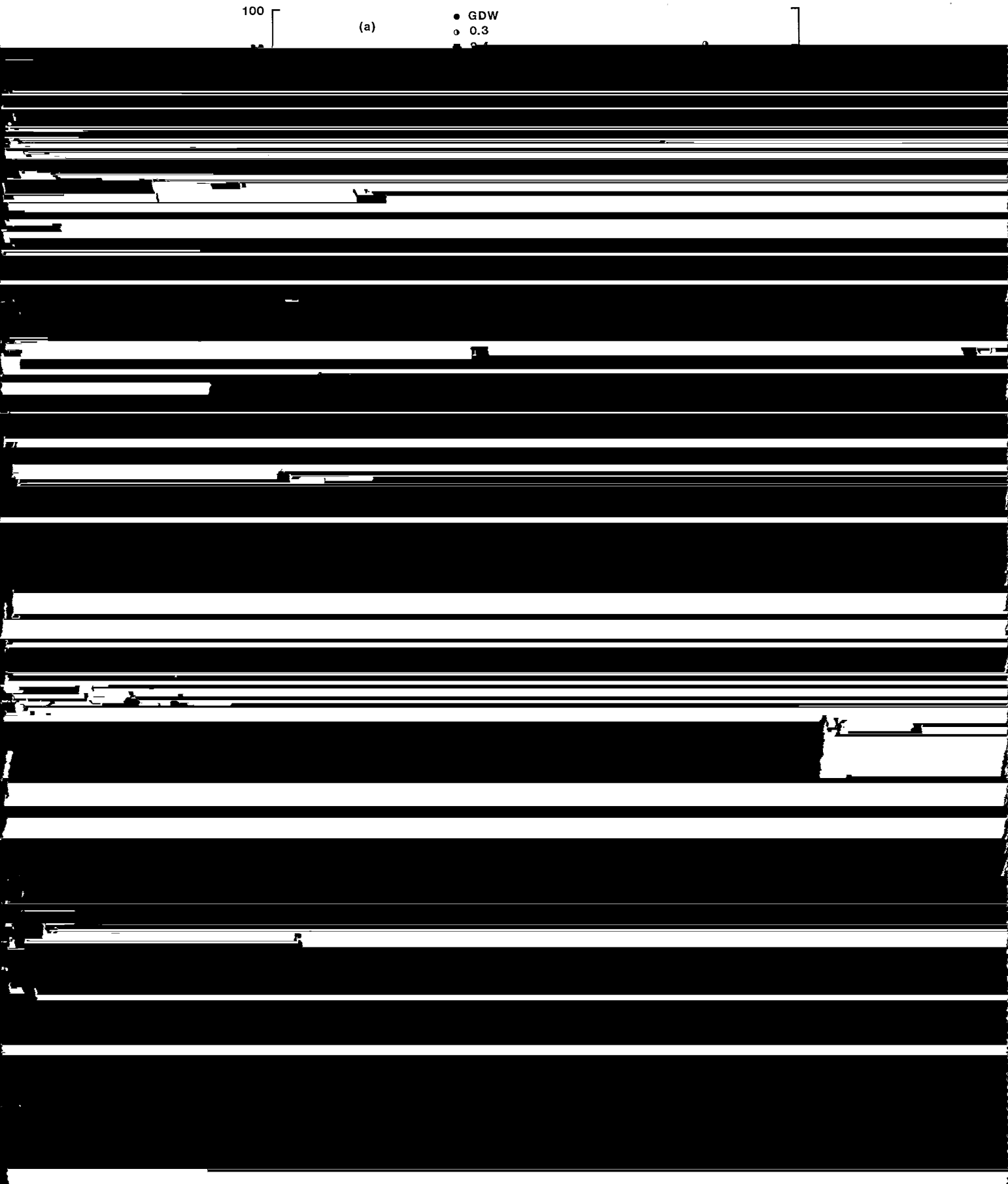


Fig. 1. Changes in water content of second-stage juveniles of *H. schachtii* in glass distilled water (GDW) and after transfer from distilled water to various sucrose (a) and trehalose (b) solutions. The broken line is the water content of unhatched, unstimulated juveniles. Vertical segments represent the limits of standard error of means.

Results

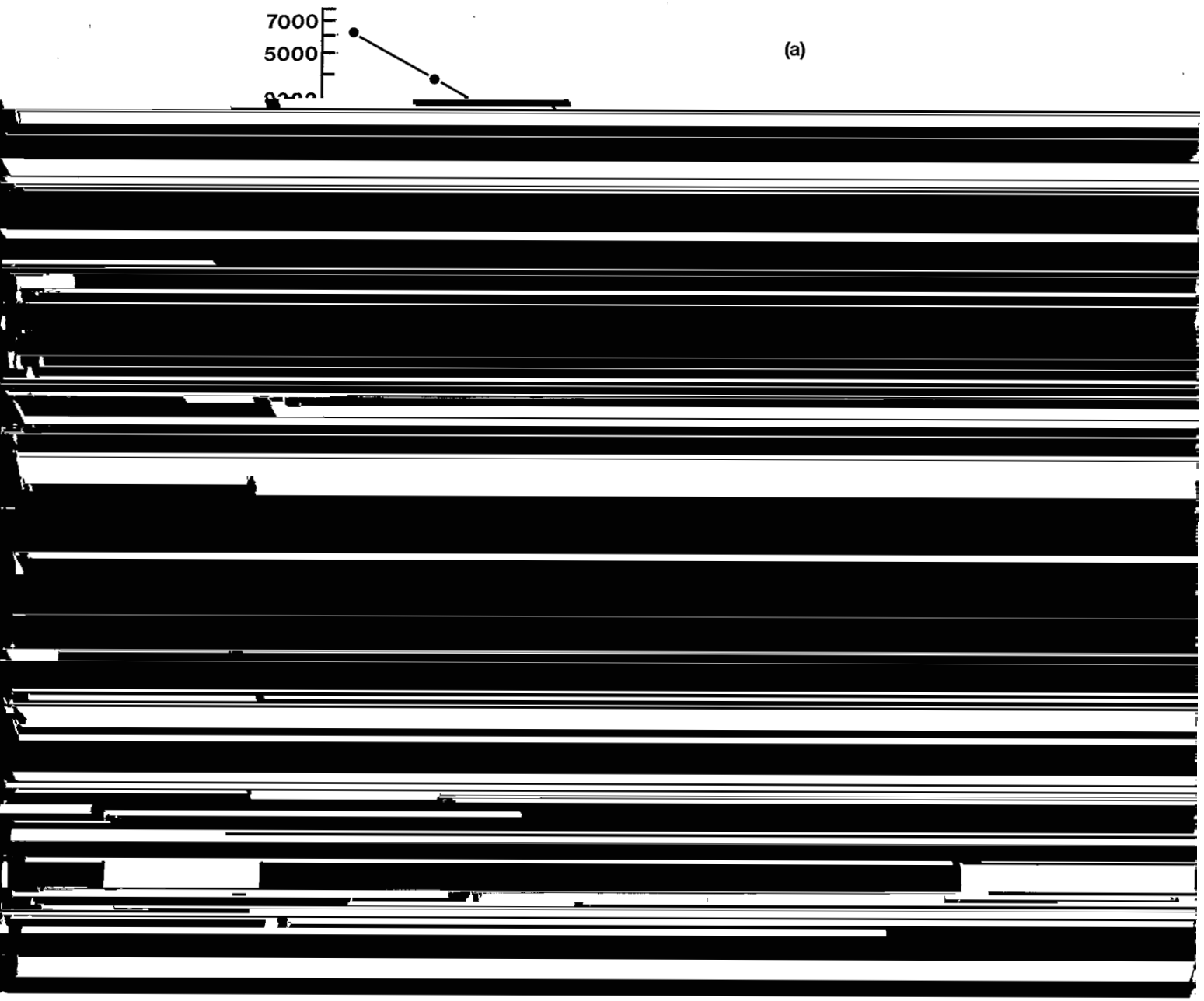
Figure 1 shows the effects of osmotic stress on the water content of free second-stage juveniles of *H. schachtii*. In both sucrose (Fig. 1a) and trehalose (Fig. 1b) solutions of 0.1M, the juvenile water content was similar to that in distilled water. In solutions more concentrated than 0.1M the juveniles lost water, the amount increasing with the concentration of the solute. The water content reached a minimum between 4 to 6h and then increased slightly to a more


100
(a)
• GDW
o 0.3

constant value after 24h. Usually the increase from the minimum was greater in the more concentrated solutions. The mean water content of twenty juveniles before hatching was 69.1 % ± 0.4, which is close to the value (69.5 %) previously obtained (Perry, 1977*a*) for a different population and similar to the water content of free juveniles in 0.3M sucrose and 0.3 to 0.4M trehalose.

Figures 2a and 2b shows the influence of 0.3 to 0.7M sucrose and inositol solutions respectively on the movement of hatched juveniles before and after adding distilled water. In the first 2 days, the percentage of juveniles moving was reduced to fewer than 15 % in the 0.6M and 0.7M solutions. The reduction of movement in the 0.5M solution was less marked until days 7 to 8, but movement was little affected by the 0.3 and 0.4M solutions compared with distilled water. The inhibition of movement was reversible after dilution, especially after 30h for juveniles previously in the 0.6 and 0.7M solutions.

Figure 3 shows the influence of increasing osmotic pressure on the hatching of *H. schachtii* Solutions of sucrose and inositol (0.1 to 0.7M) in 2mM picric acid were used. As the concentration increased hatching decreased, the pattern being the same for both compounds. Although the hatch in 0.3M solutions was less than in picric acid alone, it was still considerable and similar to that in distilled water (about 25 % of that in picric acid).



Discussion

failed to detect water uptake by *H. schachlii*

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