THE PHYSIOLOGICAL RESPONSE OF NEMATODES TO OSMOTIC STRESS AND AN OSMOTIC TREATMENT FOR SEPARATING NEMATODES

BY

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Ditylenchus dipsaci, Hemicycliophora arenaria, Meloidogyne hapla, Pratylenchus vulnus, Rhabditis spp. and Tylenchulus semipenetrans have been compared with respect to osmotic stress. After 24 hr in various concentrations of hypertonic electrolyte (NaCl) or non-electrolyte (urea), they were transferred to distilled water and their percentage mobility calculated. Their physiological responses varied considerably and from the results a treatment has been devised for separating Rhabditis spp. from D. dipsaci. The data are discussed with reference to possible mechanisms of osmotic tolerance and control and to differences in the biology of the nematodes.

Saprobic nematodes from decaying organic materials are able to tolerate widely fluctuating osmotic potentials (Stephenson, 1942; Sachs, 1950; Osche, 1952). Following prolonged treatment in hypertonic solutions and subsequent return to distilled water, however, Rhabditis spp. burst (Osche, 1952). Stephenson (1942) found that 0.51 molar NaCl was toxic to 60% of R. terrestris after 26 hr but that they recovered if in 0.34 molar NaCl. Bursting was also observed for the marine nematode Deontostoma (= Thoracostoma) californicum in distilled water following recovery in hypertonic electrolytes (Croll & Viglierchio, in press).

Experiments with phytoparasitic nematodes have indicated a wide tolerance and good recovery in osmotic treatments for Ditylenchus dipsaci, Tylenchorhynchus icarus and Xiphinema index (Blake, 1961; Wallace & Greet, 1964; and Roggen, 1966). Because of the wide variations reported for responses to osmotic stress, a comparison was made of the responses for selected nematodes in electrolytes and in the non-electrolyte, urea.

MATERIALS AND METHODS

Tap water suspensions at 15°C of the following nematodes were used: Ditylenchus dipsaci, fourth stage larvae; Hemicycliophora arenaria, all stages; Meloidogyne hapla, second stage larvae; Pratylenchus vulnus, all stages; Rhabditis spp., all stages and Tylenchulus semipenetrans, all stages.

Following concentration by centrifugation, the nematodes were placed in 10 ml of the test solution at concentrations ranging from 0.2 to 1.6 molal at 25°C and shaken slowly for 24 hr. The nematodes were then reconcentrated by centrifuga-
tion and the test solution (urea, KI, RbCl, Na₂SO₄, NaCl) replaced by an equal volume of distilled water. Controls were retained in distilled water throughout. The percentage mobility of the nematodes was then determined. The proportion of nematodes moving in each treatment and in the controls was determined by aliquot counts, and the effect of the treatment was expressed as percentage mobility with respect to water controls.

In other experiments, following the treatments, the number of nematodes passing through a Baermann funnel, was counted. Live, treated worms were stored at 15°C and their percentage mobility estimated at daily intervals for 7 days.

Fig. 1. The mobility of nematodes after 24 hr in hypertonic solutions, followed by transfer to distilled water. Percent mobility calculated with respect to water controls (--- urea; o-o-o NaCl).