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*Section of Nematology*
*Department of Zoology, Aligarh Muslim University*
*Aligarh, U.P. India*

# EFFECT OF pH AND SOME MINERAL SALTS AND FATTY ACIDS ON SURVIVAL OF *XIPHINEMA AMERICANUM*

by
Z. MALIK and M. S. JAIRAJPURI

Many workers have studied the effects of chemicals on nematodes. Stephenson (1945) observed action of fatty acids on *Rhabditis terrestris* and found it to be highly toxic. Johnston (1959) found similar results on *Tylenchorhynchus martini*. Sayre *et al.* (1965) found that the fatty acids were more toxic to *Meloidogyne incognita* and *Pratylenchus penetrans* than to the saprophytic nematode, *Panagrellus redivivus*. Banage and Visser (1965) observed the effects of fatty acids on a dorylaimid nematode and came to a similar conclusion. Soroczan (1969) while working on *Rhabditis* sp. concluded that pH range 7.5-8.8 and lower concentrations of mineral salts were suitable for the survival of larvae and the adults of this species. Pitcher and McNamara (1972) observed the effects of low concentrations of silver and cupric ions on *Pratylenchus penetrans, Xiphinema diversicaudatum* and *Aphelenchoides ritzemabosi*. Husain and Masood (1974) determined survival of *Helicotylenchus* sp. in organic chemicals while Jairajpuri *et al.* (1974) observed the effects of pH and mineral salt concentrations on survival of *Hoplolaimus indicus, Helicotylenchus indicus, Xiphinema basiri* and *Mylonchulus minor*.

In the present work the effect of pH (2-8), mineral salts (copper sulphate, potassium chloride, potassium nitrate and calcium chloride) and fatty acids (formic, butyric, propionic and acetic) on the survival of adults and juveniles of *Xiphinema americanum* Cobb have been studied.

## *Material and methods*

The nematodes (adults and all the four juvenile stages of *X. americanum*) were collected from the campus of the Aligarh Muslim University. The adults and different juvenile stages were kept in separate petri-dishes. The phosphate buffers, different concentrations of mineral salts and acids were prepared in distilled water.

To study the effects of hydrogen ion concentration the nematodes were treated with phosphate buffers of the pH range 2 to 8 (2, 3, 4, 5, 5.4, 6, 6.6, 7, 7.4 and 8). To determine the effects of salts, the adults and the juveniles were exposed to the following six molar concentrations of salts (0.5M, 0.4M, 0.3M, 0.2M, 0.1M and 0.05M). Similarly, for each acid eight concentrations were taken (1N, 0.8N, 0.6N, 0.4N, 0.2N, 0.1N, 0.01N and 0.001N). After recording immobilization time of the nematodes at a particular pH, they were transferred to cavity-blocks containing tap-water in order to determine their survival time. The survival in tap-water and in the chemicals was recorded separately for determining the degree of susceptibility of the adults and the juveniles. The nematodes were considered 'dead' when repeated proddings with a picking needle produced no visible movements. The immobilization time was recorded with the help of a stop-watch. In the first hour, observations were taken at intervals of 5 min, in the second hr after 15 min and afterwards at intervals of one hr. If nematodes died between any two readings, a mean of the two was taken as the immobilization time. Those nematodes which survived longer than 24 hr in a medium were transferred to fresh solution of the same. Each treatment was repeated ten times.

In the text and figures $L_4$, $L_3$, $L_2$ and $L_1$ stand respectively for the fourth, third, second and the first stage juveniles of *X. americanum*. The adults represent only the females as no males were found in the population which was studied.

## *Results*

The pH range 2-3 of phosphate buffer proved to be highly toxic to adults and juveniles, and the survival time recorded was only 20-40 sec. (Fig. 1). Nematodes that became immobilized in the buffer solution were transferred to tap-water, but they showed no revival.

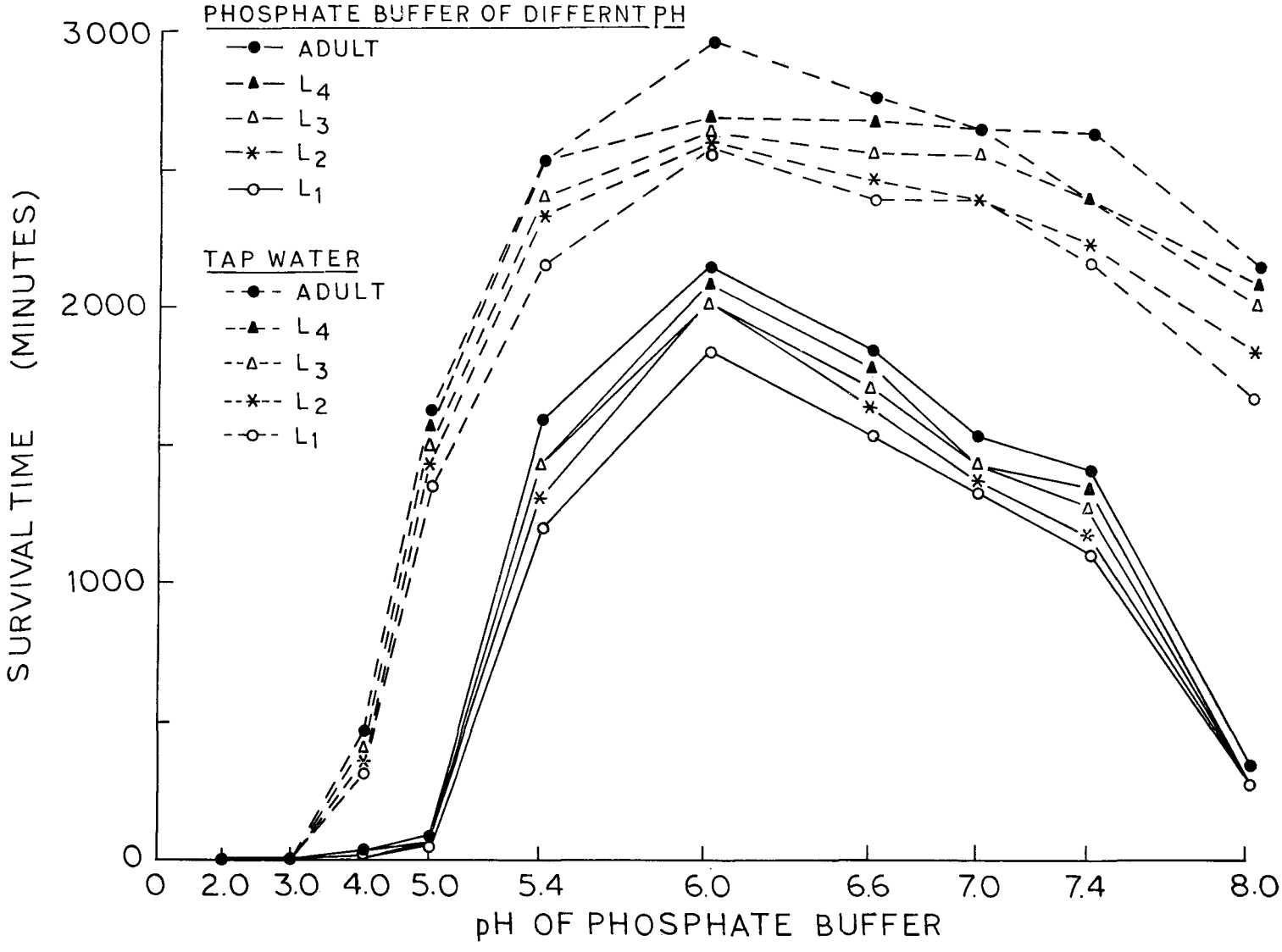


Fig. 1 - Survival time of adults and juveniles of *Xiphinema americanum* in phosphate buffer at different pH or tap-water (based on mean values).

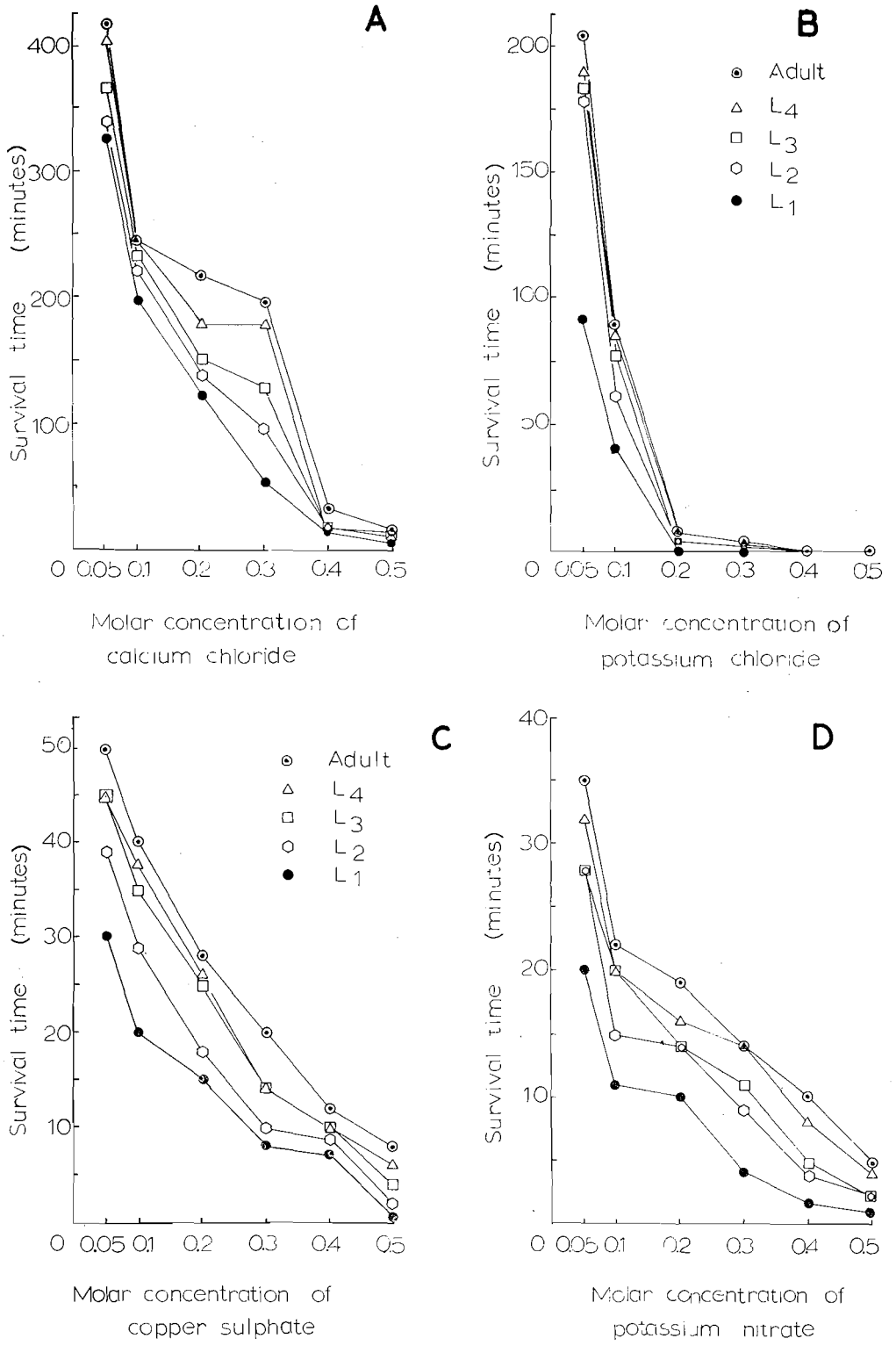


Fig. 2 - Survival time of adults and juveniles of *X. americanum* at different concentrations of salts.

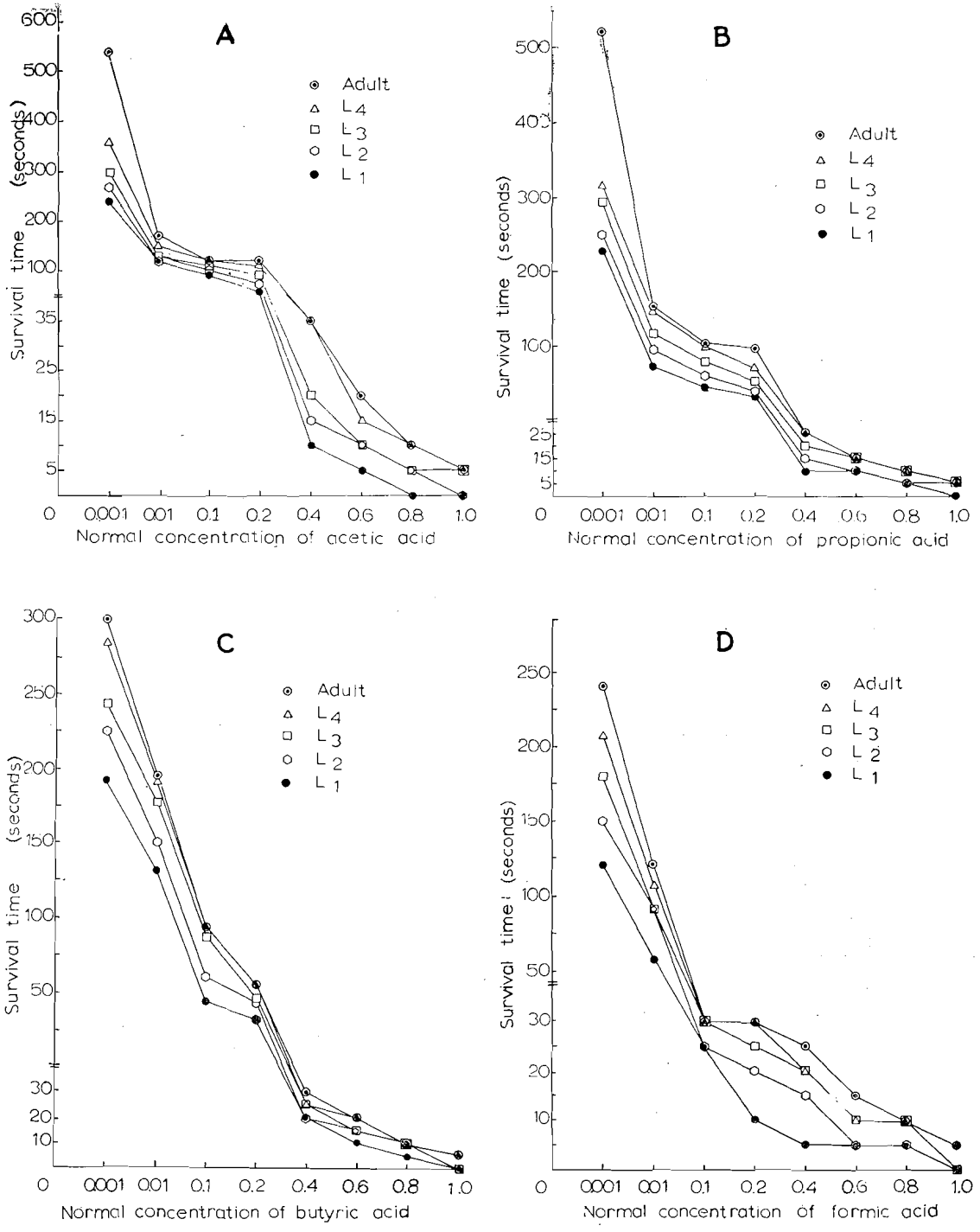


Fig. 3 - Survival time of adults and juveniles of *X. americanum* at different concentrations of fatty acids.

The maximum survival period for adults and juveniles was at pH 6-6.6 both in buffer solution and tap-water.

Potassium nitrate was the most toxic of the mineral salts tested. At the highest concentration (0.5M) adults and fourth stage juveniles survived for 3-6 min, and $L_3$, $L_2$ and $L_1$ for 60 sec - 30 min (Fig. 2). At the lowest concentration (0.05M) adults and $L_4$ survived for 30-37 min, $L_3$ and $L_2$ for 25-31 min and $L_1$ for 15-25 min. In other salt solutions the survival of each maturation stage also increased with the decrease in concentration.

All four fatty acids tested were highly toxic to *X. americanum* at low and high concentrations. Even in the least toxic fatty acid (acetic acid) the survival time was less than 9 min (Fig. 3).

## *Discussion*

From these results it is clear that adults and juveniles have almost same optimum pH range (6-6.6) but their survival times differ. Adults show maximum tolerance and first stage juveniles the least.

When exposed to different concentrations of salt solutions the nematode showed varying degrees of susceptibility. Adults survived better than juveniles in every concentration. The salts can be arranged in the following order of toxicity: potassium nitrate >copper sulphate > potassium chloride > calcium chloride.

The degree of tolerance of the nematode to acids was quite similar to that of mineral salts, adults being least, first stage juveniles the most susceptible. Formic acid was most toxic and acetic acid least, with an order of toxicity: acetic acid < propionic acid < butyric acid < formic acid. These results correspond with Stephenson (1945), but not with Banage and Visser (1965).

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## SUMMARY

The effect of different pH gradients, mineral salts and fatty acids on the survival of adults and juveniles of *Xiphinema americanum* Cobb was studied. The optimum pH was 6-6.6. In salts and acids, the adults survived longer than

the juveniles, and first stage juveniles survived for the least time. The salts and acids may be arranged in the following order of toxicity: potassium nitrate > copper sulphate > potassium chloride > calcium chloride; formic acid > butyric acid > pripionic acid > acetic acid.

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