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STUDIES ON SALINITY TOLERANCE AND PREFERENCE OF THE TUBIFICID OLIGOCHAETE *MONOPYLEPHORUS WALTAIRENSIS*

B. V. S. S. R. SUBBA RAO, T. VENKATESWARA RAO, D. VENKATA RATNAM AND A. CHANDRA SEKHAR REDDY

Department of Zoology, Andhra University, Waltair - 530 003

ABSTRACT

Salinity tolerance and preference capacities of a tubificid oligochaete *Monopylephorus waltairensis* was studied over a wide salinity range (F.W. to 30‰) *in vitro*. This worm occurs in large numbers in the intertidal sediments of the Southern Lighter Channel at the Visakhapatnam Harbour where salinities fluctuate largely. The worms showed 50% mortality within 6 days in all salinity concentrations tested. In fresh water medium LT_{50} values were obtained after a period of 3 days. Also the worms preferred low salinities in all combinations except in F.W. - 2.5‰, F.W.-5‰ and F.W.-10 ‰ salinity combinations. The distribution of the worm at low water mark is discussed in the light of the results obtained in the present study.

INTRODUCTION

WHILE pursuing the studies on ecobiology and physiology of the littoral invertebrates at the Visakhapatnam Harbour, a number of oligochaete worms were encountered inhabiting the intertidal sediments of the Southern Lighter Channel. The earlier reports on physico-chemical conditions of the harbour indicate that the waters in this channel are mostly brackish and anoxic due to influx of domestic sewage from the town (Ganapati and Raman, 1973; Subba Rao and Ganapati, 1975). Yet the sediments at the channel support the inhabitance of a number of organisms (Sarma and Ganapati, 1975). Euryhaline oligochaetes such as *Pontodrilus bermudensis, Enchytraeus barkudensis* and a polychaete worm *Lycastis indica* were also reported to occur in large numbers at this channel (Ganapati and Subba Rao, 1972; Subba Rao and Ganapati, 1975; Subba Rao and Venkateswara Rao, 1980 a, b). It is well known that salinity plays a paramount role in limiting the distribution of animal populations in marine and brackish water environs (Kinne, 1967). The present investigation was undertaken as a part of our programme to elucidate the distribution of the tubificid oligochaete *Monopylephorus waltairensis* at this harbour.

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MATERIAL AND METHODS

Method of collection of the worms and maintenance in the laboratory were the same as described earlier (Ganapati and Subba Rao, 1972). Two sets of experiments *viz.* tolerance capacities and preference over different salinity combinations were conducted at room temperature (30±1°C). Tolerance capacity was studied by following the conventional method followed by Ganapati and Subba Rao (1972). Worms of equal size (20-25 mm) were chosen and the number of experiments varied from 10 to 20. The tolerance capacities of the worms were also expressed in LT_{50} (time taken for 50% mortality).

The preference experiments were conducted by using the simple alternative chamber as described earlier by Subba Rao *et al.*

(1980). Equal number of worms were introduced into each half of the alternative chamber over a bed of sand provided as substratum to facilitate the movement of the worms. The sand in each half of the alternative chamber is soaked with sea water of desired salinities. In the present experiments also a period of a maximum of 4 hours time is allowed to enable the worms to select the most favourable side as in our earlier experiments (Subba Rao *et al.*, 1980). No mortality was observed during the experiments. The results, averages of a number of experiments (7–20) were statistically treated with Chi-square test.

Results

The series of experiments conducted on tolerance of *M. waltairensis* to different salinity concentrations (Freshwater - 30‰) revealed that the worms show a better survival ability in low salinities. The percentage mortality of the worms increased with increasing salinities and the period of exposure (Fig. 1). This could be understood when the results are viewed through the LT_{50} values obtained. In all salinity concentrations, the worms showed 50% mortality within 6 days. The LT_{50} values obtained in salinities 10, 5 and 2.5‰ are almost similar *i.e.* 134 hrs, 138 hrs and 138.5 hrs respectively. The LT_{50} values decreased from 122 hrs to 86 hrs in salinities from 15 to 30‰. In fresh water medium 50% mortality was observed after 3 days and cent percent mortality by 7 days. The percentage survival of the worms in different salinities (2.5–10‰) ranged between 5 to 14 at the end of 8 days.

Also, the salinity preference of *M. waltairensis* was tested in 28 salinity combinations (F.W.-30‰) (Fig. 2). Different salinity combinations were offered so as to assess the preference over wider and narrower salinity ranges. The results obtained showed that when a choice between two different salinities was offered, *M. waltairensis* always preferred lower salinities excepting in F.W.-2.5, F.W.-5 and F.W.-10‰ salinity combinations. But when a choice between F. W. and salinities 15‰ and above was offered, the worms preferred low salinities only. The Chi-square values obtained are significant at 5% level in all salinity combinations presently tested (Table 1).

Table 1. *Chi-square values showing salinity preference of* monopylephorus waltairensis *(alternative chamber)*

Salinity combination	Chi-square value	'n'	Salinity combination	Chi-square value	'n'
F.W–2.5	5.76	300	5–15	6.45	200
F.W–5	12.27	160	5–20	7.91	200
F.W–10	10.59	200	5–25	22.68	380
F.W–15	5.83	400	5–30	8.42	200
F.W–20	6.34	320	10–15	12.56	220
F.W–25	7.44	320	10–30	13.94	200
F.W–30	5.01	140	10–25	6.13	200
2.5–5	4.49	200	10–30	8.51	200
2.5–10	8.32	200	15–20	4.19	200
2.5–15	8.43	200	15–25	6.19	200
2.5–20	7.57	200	15–20	7.50	200
2.5–25	8.51	200	20–25	13.32	160
2.5–30	18.16	380	20–30	4.38	200
5–10	6.98	200	25–30	4.23	200

F.W = Fresh water.

Discussion

In the recent years much attentioon is paid to understand the distribution of a number of micro and macro oligochaete worms inhabiting marine and brackishwater environments (Jansson, 1962, 1968; Giere, 1970, 1971, 1973, 1977; Lasserre, 1971, 1975). *In vitro* studies on their salinity preference and tolerence capacities in varying salinities helped much to define their distribution in different habitats. Although ecophysiological approaches made towards understanding the distribution pattern of tubificid oligochaete worms in marine and brackishwater environs are very little, such studies are considerably extended to enchytraeid worms (Jansson, 1962, 1968; Tom Fenchel *et al.*, 1967; Lasserre, 1971, 1975). A

well enchytaeid *Marionina subterranea* was found to tolerate salinities from 1.3 to 15‰ and was considered as very euryhaline (Nielsen and Christensen, 1959) The salinity tolerance ranges of two enchytaeids *Aktedrilus monospermatecus* and *Marionina preclitellochaeta* were from 1.25‰ to 20‰ and 2.5‰ to 10‰ respectively (Jansson, 1962). The Northern Baltic population of *M. subterranea* showed the highest survival in salinities 5‰ explaining their abundance in low salinities (Tom Fenchel *et al.*, 1967). Lasserre (1971) reported greater abilities to withstand wide changes in temperature and salinities with a maximum of 25°C

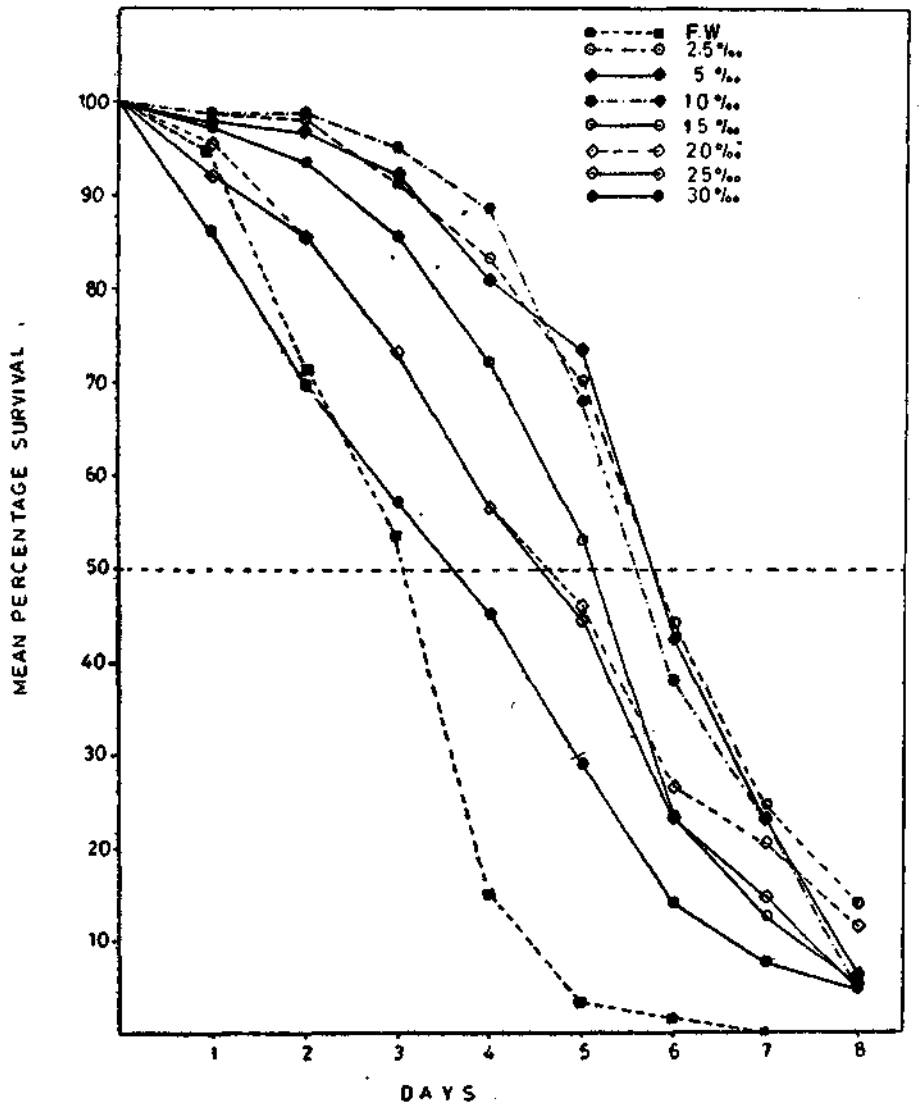

Fig. 1. Salinity tolerance of *M. waltairensis* to different test salinitess at room temperature (30 ± 1°C).

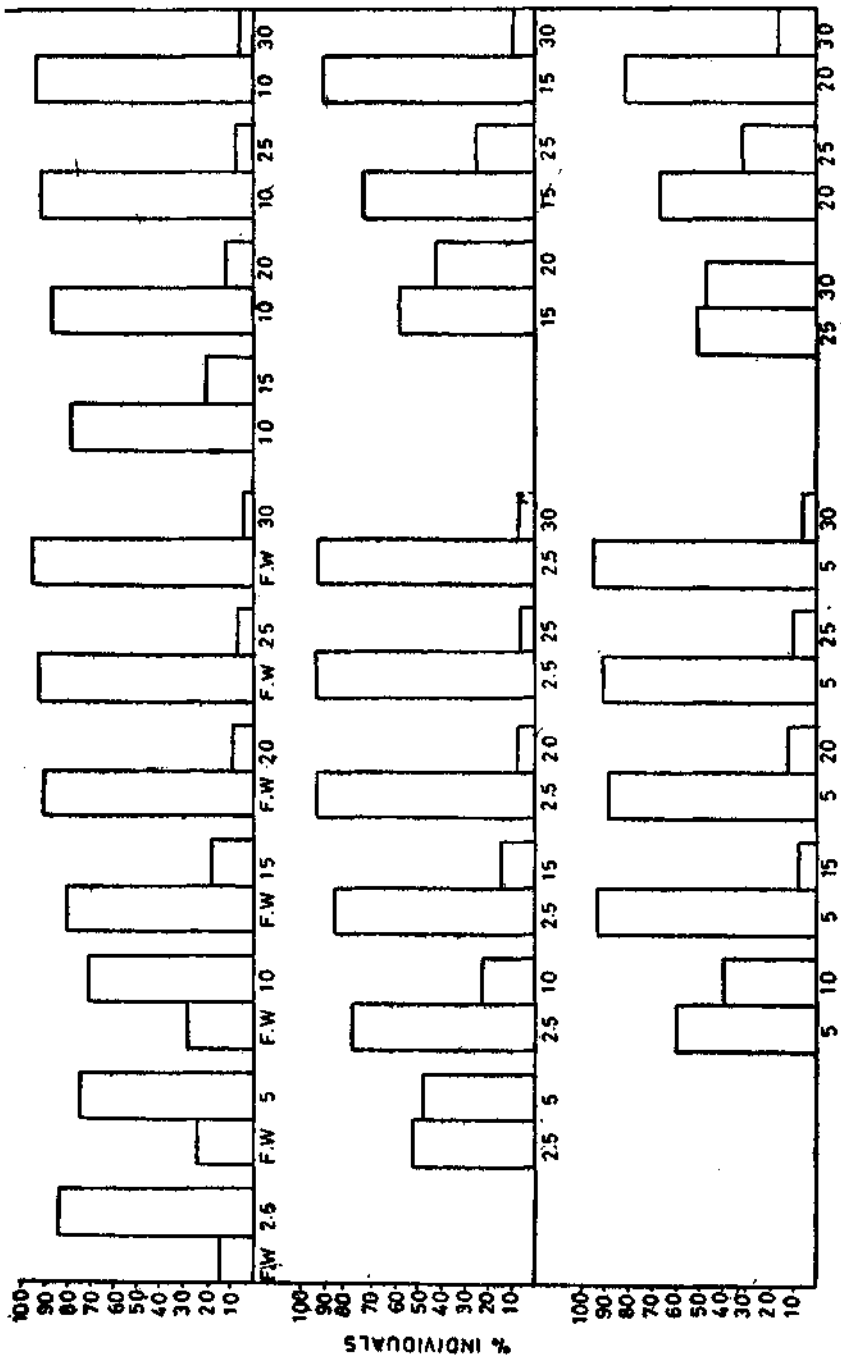

Fig. 2. The reactions of *M. wallairensis* in different test salinities.

and 15‰ in *M. achaeta* and *M.spicula. Grania postclitellochaeta* showed better survival in salinities 11‰ to 35‰ (Erseus and Lasserre, 1976). Ganapati and Subba Rao (1972) reported salinity tolerance capacities of a littoral oligochaete *Pontodrilus bermudensis* in salinities ranging from 5 to 30‰ from the Visakhapatnam Harbour. The wide range of salinity tolerance in these worms was attributed to their euryhaline nature. Recently Subba Rao and others (1980) found greater survival capacities in salinities ranging from F.W. to 30‰ in an enchytaeid *Enchytraeus barkudensis* which occurs along with *P. bermudensis.* Also, *P. bermudensis* exhibited relatively high survival capacities in high salinities (15–30‰). A common intertidal tubificid oligochaete *Phallodrilus monospermathecus* from subtropical and boreal climates was found to tolerate salinities from 5 to 40‰ and was considered as very euryhaline (Giere, 1977; Giere and Pfannkuche, 1978). In the present study *Monopylephorus waltairensis* showed high survival values in salinities ranging from 2.5 to 10‰. The low survival value obtained in F.W. and salinities 15‰ and above indicate their brackishwater inhabitance.

In addition to tolerance capacities the salinity preference of several oligochaete worms were also considered to explain their distribution (Jansson, 1962, 1968; Tynen, 1969, Subba Rao *et al.*, 1980). The salinity preferences from 2.5–6‰ in *A. monospermatecus* and 0.2–2.5‰ in *M. preclitellochaeta* were in agreement with the habitat salinities (Jansson, 1962). The distribution of *M. southerni* in middle to lower shores was explained by their preference to a low salinity of 3‰ (Jansson, 1968). A salinity preference of less than 15.5‰ in *Lumbricillus lieneatus* was attributed to its distribution in low salinity regions (Tynen, 1969). The high salinity preferences of *E. barkudensis* has been explained by its occurrence in mid water mark and above at the Visakhapatnam Harbour (Subba Rao *et al.*, 1980). In the present study *M. waltairensis* distinctly preferred low salinities (2.5-10‰) excepting fresh waters.

Since both *E. barkudensis* and *M. waltairensis* occur in the same habitat at the local harbour, a comparison of the present results with those of *E. barkudensis* would help a better understanding of their distributional pattern. The studies on the distribution of *E. barkudensis* and *M. waltairensis* at the Southern Lighter Channel showed a clear demarkation in their abundance (Subba Rao and Venkateswara Rao, 1980 a, b; Subba Rao *et al.*, unpublished data). While *E. barkudensis* populations occupying above mid water mark exhibited better survival and preference to high salinities, the present results on salinity tolerance and preference of *M. waltairensis* to low salinities justify its abundance at low water mark.

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