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EFFECT OF SALINITY ON LARVAL SURVIVAL AND DEVELOPMENT OF THE MANGROVE CRAB *METAPLAX ELEGANS*

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ABSTRACT

Larvae of *Metaplax elegans* were reared in the laboratory from hatching to first crab stage, to study the influence of salinity at different concentrations from 10‰ to 35‰. First zoea did not survive beyond 2hr at salinity 10‰. Complete development occurred in salinities from 15‰ to 35‰. The survival rates in 25, 30, 35, 20 and 15‰ salinities were 60%, 15%, 1%, 38% and 14% respectively. The intermoult duration of zoeal stages increased, when the salinity increased or decreased beyond 25‰. High survival and short developmental period was observed in 25‰ indicating the optimum salinity for the larvae of *Metaplax elegans*.

INTRODUCTION

PREVIOUS studies on the effect of salinity during larval development of crabs show that each species has specific optimum salinity for better survival and growth. In tropical waters, a few studies on the effect of salinity on larval development of crabs such as *Heteropanope indica*, *Neoepisesarma mederi* (Selvakumar *et al.*, 1987, 1988), *Cardisoma carnifex* (Rajendran *et al.*, 1987), *Sesarma andersoni* (Vijayakumar and Kannupandi, 1987) and *Metaplax distincta* (Krishnan and Kannupandi, 1987) clearly indicate that the larvae of each species, have different optimum salinity and salinity tolerance range. Hence, the present study, reports the optimum salinity for the larvae of *Metaplaxe legans* (Decapoda : Grapsidae) which has 5 zoeal and a megalopa stage before attaining first crab stage (Pasupathi and Kannupandi, 1898).

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MATERIALS AND METHODS

Ovigerous females of *Metaplax elegans* were collected from the Pitchavaram mangrove swamps (11°29′ N - 79°49′E) and maintained in the laboratory at 27 ± 1 ppt and 28 ± 1°C in a small plastic trough containing filtered sea water. After hatching, the larvae were reared using techniques described by Costlow *et al.* (1966). The larvae were reared in 6 test salinities (10, 15, 20, 25, 30 and 35 ppt). Freshly hatched *Artemia* nauplii were used as food. The bowls were examined daily for exuviae mortality in all test series. Duration of zoel stages and cumulative development in days at different salinities have been analysed using student 't' test.

RESULTS

In 10 ppt salinity all the zoeae died within 2 hours. The development could be completed only in the remaining 5 test salinities. The survival rate of the larvae of *M. elegans* in 5 test salinities is presented in Table 1. It is clear from the Table that the maximum survival rate is at 25 ppt than in either lower or higher salinities. The overall survival rate from I zoeae to first crab stage was 60%.

first crab stage was obtained on 17th day, but 15, 20, 30 and 35 ppt salinities, the first crab was obtained only on 21st, 18th, 19th and 23rd days respectively. The 't' values

TABLE 1. *Mean intermoult duration of zoeal stages I-V and megalopae of* Metaplax elegans *along with standard deviation (SD) and variance (V) at different test salinities*

Stage		Salinity (‰)				
		15	20	25	30	35
I Zoea	Mean	4.04	3.58	3.02	3.62	4.31
	SD	0.23	0.59	0.15	0.49	0.76
	V	0.05	.34	0.02	0.24	0.50
	Number	37	81	89	81	24
II Zoea	M	6.55	5.81	5.02	6.02	6.75
	SD	0.65	0.73	0.16	0.59	0.84
	V	0.42	0.54	.02	0.34	0.7
	N	25	72	82	33	5
III Zoea	M	9.27	8.07	7.04	8.40	9.75
	SD	0.81	0.72	0.22	0.49	0.58
	V	0.66	0.52	0.05	0.24	0.33
	N	22	71	80	22	3
IV Zoea	M	11.68	10.23	9.02	10.76	12.5
	SD	0.49	0.46	0.17	0.44	0.71
	V	0.24	0.21	0.03	0.19	0.5
	N	18	68	70.	21	2
V Zoea	M	15.03	13.36	12.06	14.03	16.5
	SD	0.63	0.73	0.22	0.46	0.71
	V	0.42	0.53	0.05	0.21	0.5
	N	16	42	60	20	2
Megalopa	M	21.2	19.55	17.01	19.4	23
	SD	0.47	0.65	0.13	0.51	—
	V	0.23	0.42	0.02	0.26	—
	N	14	38	60	15	1

The intermoult duration was also affected as salinity increased or decreased beyond the optimum salinity. In 25 ppt salinity, the average intermoult duration was shortest in all the 5 larval stages. The intermoult duration was increased and whole larval development took more number of days, when the salinity was lower or higher. In 25 ppt salinity the for the differences in intermoult period between different salinities are given in Table 2.

DISCUSSION

The results indicate that the larvae of *Metaplax elegans* requires a specific optimal salinity range for completion of development.

Similar observations are also reported for a number of species in temperate and tropical waters and are listed in Table 3 for comparison. The present study also shows that the rate of development is slower in both lower and higher salinities (15 ppt to 35 ppt) than the optimum salinity (25 ppt).

well developed gills (Yang and McLaughlin, 1979), which are potential salt absorbing tissue that would be advantages for the survival of larval and postlarval forms in various environments (Rabalais and Gore, 1985). High mortality of larvae in the low salinities may be attributed to prolongation of moulting as a result

TABLE 2. *'t' value for the differences in mean days for moulting of I zoea - I crab of* Metaplax elegans *at different test salinities*

Salinity	I Zoea			II Zoea			III Zoea			IV Zoea			V Zoea			Megalopa		
(‰)	N	D	t	N	D	t	N	D	t	N	D	t	N	D	t	N	D	t
15	37	4.04		25	2.51		22	2.72		18	2.41		16	3.38		4	6.2	
			**** 4.60			1.69			** 2.53			* 2.03			1.21			**** 5.29
20	81	3.58		72	2.23		71	2.26		68	2.16		42	3.13		38	5.2	
			**** 8.71			*** 2.66			*** 2.82			*** 3.07			1.01			*** 2.92
25	89	3.02		82	2.01		80	2.02		70	1.98		60	3.03		60	4.95	
			**** 11.04			**** 5.59			*** 5.02			**** 6.01			1.61			*** 4.85
30	81	3.62		33	2.40		22	2.38		21	2.36		20	3.28		15	5.3	
			**** 5.29			1.35			2.01			1.16			2.04			*** 4.52
35	24	4.31		5	2.44		3	3.0		2	2.75		2	4.0		1	6.5	

N=Number D=Days t='t' value
*P < .05, **P < .02, ***P < .01, ****P < .001.

The 100% mortality of the larvae in 10 ppt salinity may be due to lack of osmoregulatory mechanism unlike adult crabs which can tolerate wide ranges of salinity (Costlow and Bookhout, 1968). Unlike the zoeal stages, the postlarva megalopa showed a wide range of tolerance in all test salinities because of well developed gills to regulate osmoregulation (Foskett, 1977). Megalopal stages of the crabs belonging to the families Xanthidae, Grapsidae, Ocypodidae and Portunidae have

of difficulties in casting of old cuticle. The hardening of new cuticle also takes too long time, resulting in larval mortality due to osmotic loss of important ions (Hagerman, 1973). Larval susceptivity to low salinity can be a major limiting factor in the distribution of a species (Vernberg, 1983).

Low survival rate at higher salinities perhaps may be due to the inability of the larvae to osmoregulate (Foskett, 1977). He further suggested that since larvae lack a heavy exoskeleton hyperosmoticity in all salinities may be necessary to provide turgor pressure to insure integrity of thin larval cuticle. Perumal and Subramanian (1985) attributed that mortality at low and high may perhaps be due to osmotic stress *i.e.* rupture of cells at low salinity due to hyperosmosis and shrinkage of cells at higher salinities.

Thus it appears that larvae of even the closely related species of crabs irrespective of habitats posseses different optimum salinity to complete the larval development which may be attributed to genetic make up of each species which probably influence the survival and recruitment pattern.

TABLE 3. *Optimum salinity during development of different species of crabs*

Species	Optimum Salinity (‰)	References
Cancer irroratus zoea	25-30	Johns, 1981
Megalopa	25-30	Sastry and McCarthy, 1973
Cardisoma guanhumi	30-35	Costlow and Bookhout, 1968
Hepatus ephelliticus	35	Costlow and Bookhout, 1962
Hyas araneus	30-32.5	Anger, 1985
Menippe mercenaria	30-35	Ong and Costlow, 1970
Metaplax distincta	20	Krishnan and Kannupandi, 1987
Philyra corallicola	30	Krishnamurthy, 1987
Portunus spinicorpus	35	Bookhout and Costlow, 1974
Rhithropanupeus harrisii	15-24	Costlow *et al.*, 1966
Sesarma cinereum	26.7	Costlow *et al.*, 1960
Sesarma quadrata	20-25	Rajendran, 1987
Uca pugilator	30-35	Vernberg *et al.*, 1973
Uca subcylindrica	5-20	Rabalais and Cameron, 1985
Cardisoma carnifix	30	Rajendran *et al.*, 1987
Sesarma andersoni	25	Vijayakumar and Kannupandi, 1987
Neoepisesarma mederi	25	Selvakumar *et al.*, 1987
Heteropanope indica	30	Selvakumar *et al.*, 1988
Metaplax elegans	25	Present study

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