

Distribution of bacterial plasmids in marine environments

M. AVILES, J.C. CODINA, F.M. CAZORLA, P. ROMERO and A. de VICENTE

Depart. de Microbiología, Facultad de Ciencias, Universidad de MALAGA (Spain)

Introduction.

Plasmid carriage is an adaptative advantage for microorganisms, so the percentage of plasmid carrying microorganisms is expected to be higher in polluted environments (3).

Likewise, it is largely accepted that bacterial strains harbouring plasmids are more frequent in environments exposed to certain pollutants or stress factors (4,5).

Material and Methods.

Samples of water, shellfish and sediments were collected in the marine area near the Gualdalhorce river mouth in Malaga (Spain). These samples showed three different ranges of heavy metal concentrations (1) with the highest levels in sediments and the lowest in water. The microorganisms studied belong to two groups: fecal pollution indicators (Coliforms and Fecal Streptococci) and pathogens (*Pseudomonas aeruginosa*, *Salmonella* serotypes, *Aeromonas hydrophila*, *Vibrio* spp. and *Staphylococcus* spp.). The culture media employed for the isolation of microorganisms were: Endo agar, KF agar, Cetrimide agar, XLD agar, mA agar, TCBS agar and Mannitol salt agar for each microbial group, respectively. Plasmid content was analyzed using a modified alkaline-SDS procedure and electrophoresis on agarose gels (6).

Results and Discussion.

The results obtained are summarized in Tables 1 and 2, which show the frequencies of plasmid detection in relation to fecal pollution levels and to the isolation sources, respectively. A statistical test of the difference in proportions of bacteria containing plasmids in each environment was performed (3).

Globally, higher detection frequencies were observed in fecally polluted zones (A and C) with regard to those which show the lowest levels of pollution (B) (Table 1). *A. hydrophila* and *Vibrio* show higher frequencies of plasmid harbouring strains in the areas more highly polluted; however, a clear relation of the fecal pollution level and the occurrence of plasmid carrying microorganisms is not observed, when the other bacterial groups are considered. These results are in disagreement with those reported by other authors, who have observed higher frequencies of strains of *P. aeruginosa* and coliforms with plasmids in highly polluted zones (2,3).

The highest frequencies of plasmid harbouring strains were observed in shellfish samples and the lowest in the isolates from seawater. Although significant differences were obtained for the plasmid occurrence with relation to the isolation source of microorganisms (Table 2), these differences were not related to the concentrations of heavy metals. These results are in accordance with BURTON *et al.* (3), who studied the plasmid content of heterotrophic microorganisms isolated from clean and polluted environments.

Table 1. Frequency of plasmid detection related to the fecal pollution level.

	Zone B		Zone C		Zone A		TOTAL	
	n	%	n	%	n	%	n	%
<i>P. aeruginosa</i>	1	100	6	33.3	11	45.4	18	44.4
Coliforms	5	80.0	7	100	9	77.8	21	85.7
<i>Salmonella</i>	1	100	1	0.0	3	33.3	5	40.0
<i>A. hydrophila</i>	1	0.0	5	60.0	12	75.0	18	66.7
<i>Vibrio</i>	4	0.0	-	-	11	45.5	15	33.3
<i>Staphylococcus</i>	1	0.0	3	66.7	2	50.0	6	50.0
Fecal streptococci	7	71.4	3	33.3	10	70.0	20	65.0
TOTAL	20	55.0	25	60.0	58	60.3	103	59.2

Table 2. Frequency of plasmid detection related to the isolation source.

	Water		Shellfish		Sediment		TOTAL	
	n	%	n	%	n	%	n	%
<i>P. aeruginosa</i>	11	45.5	5	60.0	2	0.0	18	44.4
Coliforms	9	88.9	8	87.5	4	75.0	21	85.7
<i>Salmonella</i>	3	33.3	1	100	1	0.0	5	40.0
<i>A. hydrophila</i>	6	50.0	7	71.4	5	80.0	18	66.7
<i>Vibrio</i>	3	0.0	4	50.0	8	37.5	15	33.3
<i>Staphylococcus</i>	5	60.0	1	0.0	-	-	6	50.0
Fecal streptococci	5	40.0	5	60.0	10	80.0	20	65.0
TOTAL	42	52.4	31	67.7	30	60.0	103	59.2

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