Evaluation of the Stress Exerted by a Polluted Environment to a Marine Organism by Comparative Toxicity Tests

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Due to industrial activities the concentration of heavy metals in various water bodies can be increased to levels which aquatic organisms have not previously encountered. Among the possibilities of the organisms to react to the stress exerted by pollutants, increased tolerances have been observed.

Increased tolerance can be acquired by previous exposure to sublethal concentrations of a toxicant. Examples observed both from field work and laboratory experiments are reported by Lloyd (1960), Sprague (1970) and Bouquengneau et al. (1975) in fish, Saliba & Ahsanullah (1973) in Artemia salina, Bryan & Hummerstone (1971,1973,1973a) in the polychaete Nereis diversicolor and Moraitou-Apostolopoulou (1978) and Moraitou-Apostolopoulou et al. (1979a) in the copepod Acartia clausi.

The evolution in a biotope of tolerant strains of some species indicates that a contaminant is exerting an effect which is detrimental to the existing population. Thus, comparing the tolerance of different populations to various pollutants has been proposed as a method of assessing the pressure to which various ecosystems are being subjected (Luoma 1977).

The purpose of this study was twofold: a) to get some information on the toxic effects of cadmium and chromium to a typical marine organism the decapod crustacean Palaemon elegans, Pathke 1873, and b) to try to estimate the stress exerted by an environment which presents increased concentrations of some heavy metals to Palaemon. This was realized by comparing the resistance of a population of Palaemon living in this polluted environment to cadmium and chromium, to the resistance to the same metals of a population of Palaemon living in an unpolluted environment.

MATERIALS AND METHODS

Saronicos gulf (gulf of Athens) is an area polluted by sewage, industrial wastes and petroleum hydrocarbons. The main sources of pollution are located along the industrialized north coast of Saronicos gulf and especially in the northeast part (Elefsis bay) where the sewage outfall of the cities of Athens and Piraeus are located and many industries are found.

The state of pollution is significantly diminished southwards as has
been noted by PAVLOU & DEXTER (1973) for the organochlorine compounds and GRIMANIS et al. (1976) and AUBERT et al. (1980) for the trace metals. According to these authors, while N.E. Saronicos is a heavily polluted area, south Saronicos can be considered as an unpolluted area.

Previous studies (MORAITOU-APOSTOLOPOULOU 1974) have shown that zooplanktonic communities in Elefsis bay are strongly affected and a case of metal tolerant planktonic organism has been described (MORAITOU-APOSTOLOPOULOU 1978, MORAITOU-APOSTOLOPOULOU et al. 1979).

In the N.W. part of Saronicos gulf near Korinthos canal, some metals present high, while others low concentrations (AUBERT et al. 1980), Table I. In order to appreciate the impact of this environment to marine organisms, we performed comparative toxicological studies between this area (area II) and an area situated at the unpolluted south Saronicos (area I) (Fig. 1).

Table 1. Concentrations of some metals (in μg/l) in the two areas studied

<table>
<thead>
<tr>
<th>Metals</th>
<th>Zn</th>
<th>Pb</th>
<th>Cu</th>
<th>Ni</th>
<th>Hg</th>
<th>Cd</th>
<th>Cr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area I</td>
<td>15</td>
<td>2.9</td>
<td>1.4</td>
<td>0.7</td>
<td>20</td>
<td>0.1</td>
<td>0.1</td>
</tr>
<tr>
<td>Area II</td>
<td>25</td>
<td>10</td>
<td>1.0</td>
<td>0.7</td>
<td>20</td>
<td>0.6</td>
<td>0.1</td>
</tr>
</tbody>
</table>

Fig. 1 Saronicos gulf and the sampling areas