Accumulation of PCBs and induction of Cytochrome P-450 and mixed function oxygenase activity in juvenile sea bass *(Dicentrarchus labrax)*

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The early developing stages of marine fish are known to be more susceptible to environmental stress and pollution than mature animals; however, few data are available on the biochemical response to toxic and genotoxic chemical contaminants (1).

In this paper, we report the first results of laboratory experiments in wich specimens of *Dicentrarchus labrax*, a widely distributed fish in the Mediterranean Sea, were exposed to relatively low concentrations of PCBs in water.

About 50 juvenile sea bass, one month old and about 1 gram weight, were kept in 80 dm3 tanks in areated sea water. After seven days of acclimation, a solution of Aroclor 1254 (10 mg/cm3 ethanol) was added to give a PCB concentration of 1 µg/dm^3 (tank A) and l0 µg/dm^3 (tank B). Daily, about 5 g of fish feed were added to each tank; then half the water was renewed and a proportional solution of Aroclor 1254 added. Specimens of juvenile sea bass, in which tail was not developed probably due to irradiation during the first embrional stages, were also exposed to 10 µg/dm^3 PCB in water (tank B). Control tanks, without PCBs, were kept for the entire experimental period.

At 0, 7, 15 and 30 days of exposure, six fish from each tank were sacrificed and divided in two pools : the first one was used for PCB determination, while the second fraction was homogenised and analysed for Cytochrome P-450 content (2) and for BPH (3) and NAD (P) H reductases (4) activity in microsomal pellets. Protein concentration was measured by the method of LOWRY *et al.*, (5). The PCBs in water and fish were determined by ECD gas chromatography according to FOSSATO (6).

The results are reported in Tables I and II.

Table I

Dicentrarchus labrax; juvenile fish without tail treated with PCB Aroclor 1254; C= control, B= 10 µg/dm^3. Data, referred to wet weight, are expressed as follows : Time = days; Protein = mg pr/g; PCBs = µg/g; P-450 = nm protein/mg; BPH = fluor unit protein/mg min.; NAD (P) H ferricyanide and Cytochrome c reductase = nm reducted/mg protein min.; n. d. = not detected.

Time	Tank	Protein	PCBs	P-450	BPH	NADHferr	NADHcitC	NADPHcitC
O	C	3.47	0.02	0.111	6.79	1202	1.15	7.16
O	B	4.34	0.02	0.063	3.89	825	n.d.	7.44
7	C	3.44	0.03	0.028	3.07	1098	n.d.	n.d.
7	B	1.99	3.17	0.052	n.d.	1392	57.12	4.00
15	C	3.47	0.09	0.064	0.03	1078	n.d.	n.d.
15	B	2.62	3.69	0.143	3.53	1096	n.d.	n.d.
30	C	2.94	0.11	0.028	n.d.	866	n.d.	n.d.
30	B	2.01	12.45	0.056	7.34	1486	n.d.	n.d.

Table II

Dicentrarchus labrax; juvenile fish with tail treated with PCB Aroclor 1254; C = control, A = 1 µg/dm^3 , B = 10 µg/dm^3. Data, referred to wet weight, are expressed as follows : Time = days; Protein= mg pr/g; PCBs= µg/g; P-450= nm protein/mg; BPH = fluor. unit protein/mg min.; NAD (P) H ferricyanide and Cytochrome c reductase = nm reducted/mg protein min.; n. d. = not detected.

Time	Tank	Protein	PCBs	P-450	BPH	NADHferr	NADHcitc	NADPHcitc
O	C	1.41	0.02	0.053	n.d.	1155	n.d.	4.66
O	A	1.28	0.02	0.084	n.d.	1055	n.d.	9.09
O	B	2.75	0.02	0.084	1.99	941	n.d.	n.d.
7	C	1.09	0.03	0.080	3.86	1263	7.66	n.d.
7	A	1.59	0.33	0.088	n.d.	1574	n.d.	3.66
7	B	1.37	2.45	0.087	2.86	1049	n.d.	n.d.
15	C	1.62	0.08	0.118	4.60	1389	n.d.	n.d.
15	A	1.97	0.46	0.082	10.20	1541	n.d.	7.00
15	B	1.64	5.29	0.209	14.26	1687	2.10	10.11
30	C	1.07	0.13	0.035	n.d.	768	10.87	8.35
30	A	1.80	1.01	0.030	2.39	1333	n.d.	7.65
30	B	0.82	10.22	0.050	5.74	1151	12.56	16.53

The PCB content showed an increase with time in both treatments, reaching the highest values in animals from tank B. After 30 days of exposure to a nominal concentration of 10 µg/dm^3., the bioconcentration factor, on a wet weight basis, varies between 1,000 and 1,200, indicating an active bioaccumulation.

The pattern of enzymatic parameters is more complex and erratic. Cytochrome P-450 showed a clear increase over the control in treatment B after two weeks of exposure, but it decreased to the end of the experiment.

NADH ferricyanide reductase activity presented a slight increase in both experiments, the difference between treated fish and control becoming evident at 30 days.

NAD (P) H Cytochrome c reductases and BPH activity showed no clear responses, the values often being near the detection levels.

These preliminar results indicate an active bioaccumulation of PCBs by juvenile sea bass and give evidence of contaminant induced damage at the biochemical level for tissue PCB content of about 10 µg/g wet weight.

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