Polychlorinated Biphenyls in the Seastar *Acanthaster Planci*

by
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Gonad tissue of the starfish Acanthaster planci ("Crown-of-Thorns") from various places in the Pacific has been analyzed previously for organochlorine pesticide residues (McCLOSKEY and DEUBERT, 1972). Clean-up procedures applied during the pesticide residue analysis did not accurately separate pesticides from interfering compounds, including PCBs.

Since our initial work (McCLOSKEY and DEUBERT, 1972), progress in analytical procedures has made it possible to estimate PCB levels in small amounts of tissue.

Materials and Methods

Gonad tissue specimens were taken from starfish caught in the areas of the Eastern Caroline Islands (Table 1, numbers 1-3), Guam (Table 1, numbers 4-6), and Eniwetok Atoll, Marshall Islands (Table 1, number 7).

TABLE 1

Origin and estimated PCB content of samples of gonad tissues of A. planci from the Pacific. PCB estimates based on Aroclor 1254.

No.	Location	Date	ppm PCB
1	Dublon Island, Truk Atoll	June 14, 1970	0.05
2	Pis Island, Truk Atoll	June 17, 1970	0.03
3	Northeast Pass, Truk Atoll	June 19, 1970	0.02
4	Merizo, Guam	June 25, 1970	0.02
5	Anae Island, Guam	June 11, 1970	0.04
6	Merizo, Guam	June 25, 1970	0.21
7	Bogen Island, Eniwetok Atoll	June 24, 1971	0.01

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The tissue samples were extracted as described earlier (McCLOSKEY and DEUBERT, 1972). Cleanup was done using disposable Pasteur pipettes. The columns were filled with Florisil activated for 24 hours at 130°C. Columns were packed in petroleum ether (30-60°C) and washed with 20 ml of petroleum ether prior to use. Extracts equivalent to one to two grams of fixed tissue were used for cleanup and PCBs were eluted with a volume (5-7 ml) of petroleum ether (30-60°C) that eluted 1 microgram of Aroclor 1254 to approximately 96 percent. Since extractions were carried out at different times, the volume of solvent necessary to obtain this recovery was determined every time. A solvent blank was run with each extraction. Eluates were concentrated to 0.5 ml, and 1 to 5 microliter aliquots were analyzed by GLC-EC.

The gas chromatograph was a Varian 2700 equipped with a 5' x 1/8" stainless steel column packed with 3% QF-1 on 100/110 Anakrom ABS. Operating parameters were as follows: column 190°C, detector 220°C, injector 225°C, N_2 25 ml/min, att. 8, range 10^{-10}, Sargent Recorder SRG at 5 mv, medium speed.

TLC analysis was also carried out as described earlier (McCLOSKEY and DEUBERT, 1972). Nitration of cleaned-up residues did not change the basic peak pattern, except to add new peaks.

Results

All tissue extracts produced peaks with the following retention times relative to p,p'-DDE: 0.45, 0.79, 1.0, 1.09, 1.35, 1.70, 2.14, 2.61, and 3.19 (Figure 1). These peaks were also obtained with Aroclor 1254, and they did not disappear after nitration. The values were very similar to the ones reported by RISEBROUGH, et al. (1969).

TLC analysis of the extracts produced spots with R_f values 0.72, 0.80 and 0.92, whereas Aroclor 1254 produced two overlapping spots. Approximate R_f values were 0.7 and 0.8.

The peak patterns were similar to the peak patterns produced by Aroclor 1254 except for the peaks at R_t 0.45 and 0.79, which were larger in the extracts than the corresponding peaks produced by Aroclor 1254. Peaks 1.0, 1.09, 1.35 and 1.70 in the extracts and the PCB mixture were identical in size; the others with longer retention times were too small in the extracts for reliable measurement. Because of the overlap of peaks at R_t 1.0 and 1.09, only peaks at R_t 1.35 and 1.70 were used to quantitate the PCB residues extracted from the tissue samples. The estimated quantities are given in Table 1.

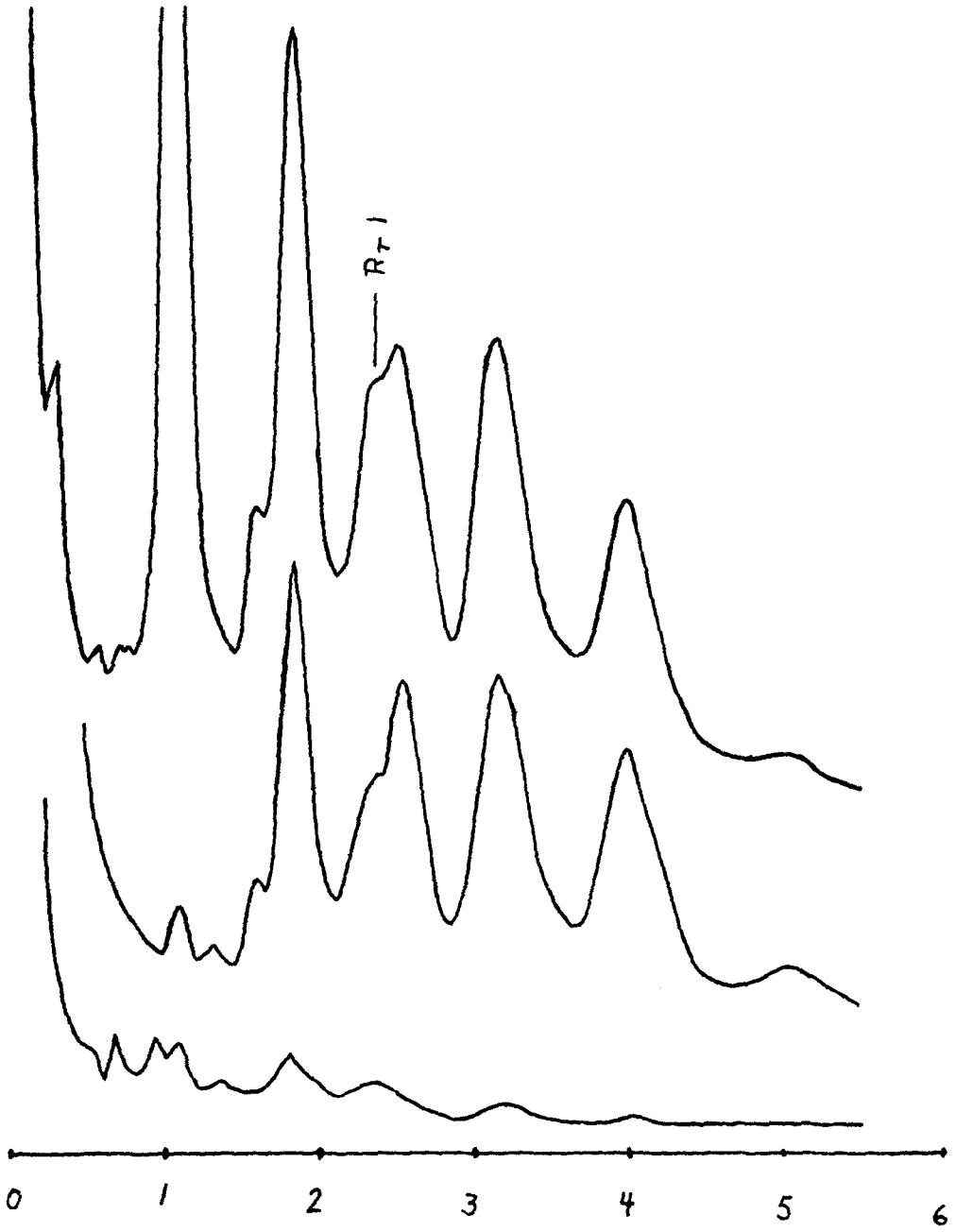

Fig. 1. From top to bottom: gas chromatograms of extract No. 1 (see Table 1), Aroclor 1254, and a solvent blank.

Discussion

The accuracy of the quantitation cannot be determined because of the differences between the peak patterns produced by Aroclor 1254 and the extracts. However, quantities estimated in this study seem to be in agreement with data obtained in similar studies on marine organisms. Marine fish from New Brunswick and Nova Scotia contained 0.02 to 0.54 ppm (ZITKO, 1971), and marine animals from California contained 0.04 to 1.04 ppm PCBs (MUNSON, 1972). Shellfish from the Massachusetts coast analyzed in this laboratory contained 0.08 to 0.60 ppm PCBs relative to wet weight.

Acknowledgements

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