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Organochlorine Pesticide Contents in *Cardisoma guanhumi* Latreille

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The land crab, Cardisoma guanhumi Latreille, inhabits coastal regions in the tropics and subtropics of the Western Hemisphere. Eggs are spawned in seawater where they undergo five zoeal and one megalops stage. Metamorphosis to first crab stages or juveniles and settlement on land begins in a period of one and one-half month from time of hatching with a carapace width ranging from 0.7 to 1.5 mm (Costlow & Bookhout 1968; Rojas personal observation). Juveniles occur close to the seashore and adults penetrate inland up to 8 kms (Feliciano 1962).

In Puerto Rico, the fisheries of this land crab have been of considerable economic and dietary importance throughout this century (Rojas 1978). However, the catch of C. guanhumi as a percentage of total fisheries in Puerto Rico, decreased from 7% in 1962 to less than 0.5% in 1977 (Rojas 1978). The price of a dozen live crabs has increased from $1.25 in 1957 (Feliciano 1962) to $12.00 in 1984. The meat which was previously marketed processed in Puerto Rico is no longer available because of high cost and scarcity of the local crabs. Crab meat is being imported into Puerto Rico at a rate of one-half million pounds a year (Rojas 1978).

Among the possible reasons for the decline in catch of the land crab, is the expansion of the urban, agricultural and industrial areas into the low-lying coastal zones. This has increased the exploitation of the land crab population by artisanal gatherers, who used the crab as a source of food and additional income and exposed the crab populations to pesticides (Canals 1979; Martorell 1971).

Cardisoma has been considered a pest due to the damage done to cultivated crops such as sugar and rice. Farmers were advised to use Aldrin and inorganic phosphorus to combat this pest (Schmidt 1938; Feliciano

1962; Martorell 1971). This practice may be a major reason for the decline of this important fishery of Puerto Rico. Bookhout (1974) showed that the use of Mirex (another chlorinated hydrocarbon insecticide) in concentrations of only a few parts per billion significantly reduced survival of crabs.

In this study, data on pesticide content of the land crab, Cardisoma guanhumi, were obtained to assess their role in accounting for the decline in land crabs and potential hazards to human health.

MATERIALS AND METHODS

Land crabs were collected in three areas to discern variability in pesticide contamination of crab meat. The edible portion was analyzed because it was suspected that the pesticides were concentrated in the crab due to prolonged use of pesticides in their natural habitats. Two sites were chosen in Puerto Rico where land crabs have been exposed to pesticide and industrial pollution. Guanajibo Valley area is located on the west coast of Puerto Rico near Mayaguez. This area is mainly agricultural with some residential and industrial development. The main crop is sugar cane with pesticides being used to enhance production. Mangrove areas fringe the coastal section and lagoons. The sugar cane fields and mangrove areas are the main land crab habitats in this region. Guayanilla Bay area is located on the south coast of Puerto Rico. Guayanilla is a mixed agricultural, residential and commercial region with extensive industrial development. Within the bay, mangrove areas are still present. The degree of agricultural to industrial development of these sites can be said to be representative of the coastal areas of Puerto Rico (Tilly 1979).

The Virgin Islands National Park, started in December 1956 in St. John was used as control site. In the park areas land crabs are protected from human predation and from pollution. Crabs were collected from Mary's Creek, Great Lameshur, Little Lameshur, Reef and Europa Bays in St. John. All these five areas being mangrove forests that lie within the coastal regions.

In the field, monthly sampling was conducted for crabs. They were caught with the use of wooden traps baited with fresh fruit or by hand from burrows. The crabs were transported on ice to the laboratory. Once in the laboratory, the catch was individually measured with a hand caliper to the nearest 1.00 mm (carapace width), weighed and sexed (FAO 1976b). They were individually wrapped in aluminum foil, labelled and deep frozen until muscle tissue was removed for analysis. Muscle

was extracted from the carapace, legs and chelae using metal forceps and from the legs with the use of a mortar and pestle. Since size of animal has been related to concentration of toxic substances, collections were sorted by size class (Phillips 1980). The size of the crabs used in composite samples were defined as carapace width, these were: less than 2.5 cm, between 2.5 and 5 cm, between 5 and 7.5 cm and greater than 7.5 cm (FAO 1975; 1976a,b). Collections were also analyzed by geographic area and season.

A composite of the samples was done to provide an estimate of average contamination and to minimize within size class variability. At all three stations, a quarterly composite of each of the four crab sizes was analyzed. The number of individual crabs available for the composite varied according to the catch in the respective size range during each season from 1 to 65. As a result, the total tissue yield varied for each composite. The number of replicates for the chemical analysis varied.

Organochlorines were analyzed following the method described for fish in the Official Methods of Analysis of the Association of Analytical Chemists (1980). Detections were made of 50 gms of sample which was mixed with $Na_2 SO_4$ in a blender to remove residual water, the sample was then homogenized in petroleum ether. Each sample was fractionated on a 22 mm Florisil column. The first fraction was eluted with 6% ethyl ether/petroleum ether; the second fraction eluted with 15% ethyl ether/petroleum ether. The sample was concentrated to suitable volume for analysis by electron capture gas chromatography. The organochlorine pesticides analyzed, with their respective detection limits, were DDT (20 ppb), DDE (20 ppb), aldrin (0.08 ppb), dieldrin (1.0 ppb) and PCB's (2 ppb).

RESULTS AND DISCUSSION

Decapod crustaceans are among the most sensitive species to organochlorines (Phillips 1980). Death occurs from suffocation due to interference with the oxygen uptake at the gills and if death does not occur the chlorinated hydrocarbons are stored and concentrated in the organism's fatty tissues (Laws 1981).

Organochlorine pesticide content has been analyzed in the crab meat of 24 composite samples grouped by geographic area, collection time and size class representing 512 crabs. In only one of the composite samples was an organochlorine pesticide found. Lindane

was found in a concentration of 4.5 ppb in a Guayanilla Bay sample, size class 5-7.5 cm carapace width. The other samples either contained no organochlorines or they were below the level of detection.

The results obtained suggest that, at least during the time sampled, the land crab decline was not due to organochlorine pesticide contamination. This, however, does not preclude the possibility that the dramatic drop in the population in years past was related to pesticide use. From the samples analyzed for organochlorine pesticides, land crabs do not appear to constitute a threat to human health.

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