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Review of the effects of DDT on the blue crab, Callinectes sapidus.

Willard A. Van Engel,
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 10 April 1948

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Agencies of many states and of the Federal Government have investigated the use of DDT in the control of obnoxious pests in water and on land; particular attention has been given the control of the malaria mosquito and of field and orchard insects.

For the most part, emphasis has been placed on studies of the effectiveness of dusts, solutions and emulsions of DDT and their means of dispersal, and comparisons with other poisons. In general, there has been good agreement on results and recommended practices. However, many of the published reports have stressed concern over the lack of information on the possible harm that would be done to beneficial forms of life. There are only a few brief summaries of studies on mammals, birds, amphibians, fish and a host of invertebrates. In most cases, invertebrates, fishes and other cold-blooded vertebrates were more readily affected than were birds and mammals. To minimize unintentional deaths in these beneficial forms, minimum lethal doses of DDT have been recommended for the control of pests.

Although the sensitivity of crustaceans, particularly fresh-water forms, has been noted in a large number of reports, there are few observations on crabs: two published articles and two unpublished field and laboratory studies.*

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- *1) L. A. Sandholzer. 1945. The effect of DDT upon the Chesapeake Bay blue crab (Callinectes sapidus). Fishery Market News, Vol. 7, No. 11, pp 2-4.
 - 2) Clarence Cottam and Elmer Higgins. 1946. DDT: its effect on fish and wildlife. Circular 11, U. S. Fish and Wildlife Service.
 - 3) Notes of the Chesapeake Biological Laboratory, Solomons Island, Md. 1946. Unpublished.
 - 4) Notes of the Virginia Fisheries Laboratory, Yorktown, Va. 1947. Unpublished.
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Sandholzer treated both hard and soft shell crabs in 25 gallon tubs with

concentrations of 1, 5, 10, and 20 parts per million of DDT (25 per cent), Triton x-100 (emulsifier) (10 per cent), and xylene (65 per cent). Tremors and paralysis were observed within the first 15 minutes, soft crabs being more quickly affected than the hard shells. In every instance the crabs were removed from the tubs after 15 minutes or one hour of exposure to the poison and placed in floats of fresh sea water and observed for one week. Eighty per cent of the hard shells and 100 per cent of the soft crabs survived the seven day period. Sandhelzer thought that the DDT emulsion he used would produce a greater effect than DDT applied as an oil spray. He made no observations on the effect of DDT in an oil solution, he did not try feeding crabs with DDT-poisoned food, and he did not observe the specimens for a period longer than seven (7) days.

Cottam and Higgins reported that the "southern 5 miles of Island Beach, in Ocean County, N. J., including the shallow water just off shore in Barnegat Bay, were sprayed by airplane with an estimated 1/2 pound of DDT (in an oil solution) to the acre for the purpose of eliminating mosquitoes." Three days later mosquitoes were scarce and an estimated 100,000 small dead fishes were observed along the bay shore. No dead or dying crabs were observed until the seventh day following treatment, and on the tenth day "150 dead or dying crabs were found over a 200-yard stretch, while those in adjacent unsprayed waters were healthy."

In addition, they report that part of Wallops Island, Virginia, was sprayed with 0.8 pound of DDT (in an oil solution) to the acre. Mosquitoes were temporarily eliminated, and initial mortality was high among blue crabs in pond and small streams. No further effect was observed on the third day.

In 1946, part of the staff of the Chesapeake Biological Laboratory, Solomons Island, Maryland, tested the reaction of crabs and striped bass to 5 per cent DDT in oil and 5 per cent DDT in oil plus a water soluble carrier. The specimens were placed in a net, 15x15x7 feet, and from 3 1/4 to 3 3/4 pints of solution sprayed on the water. Between six and fourteen hours later, the specimens were

removed to fresh sea water. They were observed for 5 1/2 days; no deaths occurred.

Observations were made at the Virginia Fisheries Laboratory in the summer of 1947 on the effects of DDT dust, DDT plus kerosene, and kerosene alone. All concentrations of DDT of 0.5 pounds per acre and larger, either as dust or in solution in kerosene caused death within two days. Kerosene alone (when applied at the rate of spraying 0.5 pounds of DDT per acre) produced death within two days.

During the summer of 1947, spraying of salt marshes south of Floyd's Bay to Langley Field with 20 per cent DDT, 52 per cent Diesel Oil No. 2, and 28 per cent Auxiliary Solvent (Velsicol NR 70 or Culicide B) was done by airplane at the rate of 0.28 to 0.3 pounds per acre. Within two to three days, dead and dying crabs were found along the edge of the salt marsh and its various creeks -- some were found dead or paralyzed about five miles north of the sprayed area. Soft crabs and buckrams seemed to be particularly affected. For the next four weeks crabs were seen dead and dying in the sprayed and unsprayed areas. The number of living, dead, and dying during this period was noticeably smaller than the number in the area before the initial spraying. Five weeks after the first spraying, another was given: within three to four days crabs were found dead and dying again in large numbers.

CONCLUSIONS

There is every indication that DDT, when applied at the rate of 0.3 pounds per acre or greater, has a pronounced effect on crabs, the symptoms of poisoning beginning with agitation, tremors and paralysis and ending in the death of the organism. Light dosages may or may not have immediate effects. DDT is known to be accumulated in feeding experiments on other animals, and it is possible that delayed effects of any dosages are due to the increased concentration of the poison in the body by direct absorption or through feeding on other poisoned organisms.

Kerosene or other oils increase the toxic effect and by themselves may account for some mortality.

In any area where DDT spraying is contemplated, the value of riddance of noxious pests must be weighed against the harm that will be done to beneficial forms. In a salt marsh area, freedom from mosquitoes must be weighed against the contribution by crab and crabbing to the economy of the area.

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