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# Uptake of the Herbicide Pendimethalin by the Sea Nettle *Chrysaora quinquecirrha*

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The sea nettle (Chrysaora quinquecirrha), a venomous pelagic coelenterate, has been estimated to be responsible for a reduction of recreational use of the Chesapeake Bay by as much as 80%. Methods of control for this jellyfish are non-existent. The ecological niche of this jellyfish is not well understood, nor are conditions which enable it to occasionally reach concentrations of $2/m^3$ over portions of the Chesapeake Bay.

Contact with the tentacle of the sea nettle results in a painful urticarial sting as the result of envenomation (BURNETT & CALTON 1974a). The venom consists of a complex mixture of enzymes and pain-producing agents enclosed in an intracellular organelle called a nematocyst (BURNETT & SUTTON 1969). An outer fringe of approximately 18 tentacles, known as fishing tentacles, contain high quantities of pain-producing agents (CALTON & BURNETT 1978). The inner tentacle mass, the mesentery tentacles, have digestive functions, and the venom from these tentacles contains high quantities of digestive enzymes (BURNETT & CALTON 1974b). The effect of herbicides commonly used in areas surrounding the Chesapeake Bay on these jellyfish, and the use of these animals as an indicator of water quality, is the subject of this preliminary report.

## MATERIALS AND METHODS

Jellyfish were collected from Meridith Creek, St. Margarets, MD, transported to the laboratory in Baltimore the same day, and were placed in aquaria with no more than 1 g of jellyfish/l of water. An analytically pure sample of pendimethalin (Prowl®, N-(1-ethylpropyl) -3,4-dimethyl-2,6-dinitrobenzenamine) (courtesy of EPA, Beltsville) was added to the water (10 ppm) and mixed by movement of the aeration nozzle. Care was taken to avoid damage to the jellyfish. After the desired

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length of time, the jellyfish was removed from the aquarium manually and flushed with approximately 10 times its volume of fresh water to remove adsorbed herbicide. To determine whether uptake was a function of water concentration, experiments were run in which jellyfish that had been in water containing pendimethalin at 10 ppm for 16 h, were placed in fresh water for 6 h before proceeding. The jellyfish were dissected and separated into mesentery tentacles, fishing tentacles, and bell and blended or blended whole. After lyophilization, each portion was extracted with ethyl acetate (equal to volume of wet jellyfish, three times). The solvent was removed under a steam of nitrogen, and the residue was taken up to a concentration representing 100 mg of jellyfish (wet wt.)/mL in ethyl acetate. All tests were performed on individual jellyfish or parts thereof.

Extracts were analyzed using a gas chromatograph equipped with flame ionization detector and a 2m X 2mm i.d. column packed with 3% SP2401 on 100-120 mesh Supelcoport. Injector and detector temperatures were 300°C; nitrogen carrier gas flow was 40 mL/min and the column temperature was 200°. Under these conditions, pendimethalin eluted at 3 min, 35 s.

## RESULTS AND DISCUSSION

Sea nettle actively incorporate pendimethalin into the body tissue. The most striking example was noted in the tentacles which turned yellow with absorbed pendimethalin. Uptake began within 1 h ($0.66 \pm 0.09$ ppm, wet weight) and increased steadily with total jellyfish levels reaching as high as 4.2 ppm at 16 h. The uptake was considerably higher in the tentacle ($4.9 \pm 0.9$ ppm) than in the bell ($1.1 \pm 0.1$ ppm). The mesentery tentacle incorporated pendimethalin to a greater extent ($6.4 \pm 2.7$ ppm) than did the fishing tentacle ($3.5 \pm 0.6$ ppm).

Pendimethalin did not appear to be passively transported as levels in the jellyfish did not reach those of the water in which the jellyfish was immersed although jellyfish surface levels were not determined. No visual effects of the herbicide on the pulsation or behavior of the jellyfish were noted at the concentration of pendimethalin tested which is lethal to white perch.

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