ORGANOCHLORINE PESTICIDE RESIDUES IN SOUTHERN ONTARIO SPRING PEEPERS

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Abstract—Spring peepers (Pseudacris crucifer) were analyzed by GC-ECD for 15 organochlorine pesticides of environmental significance. Only DDT, DDE, DDD, and dieldrin showed significant tissue accumulations in spring peepers. The area of collection had a history of extensive DDT application for mosquito control, but the practice of pesticide application was abandoned 26 years ago. Local extinctions of amphibians have been documented in the immediate area, and the long-term effects of organochlorine pesticide exposure are implicated as plausible causes of these extinctions.

Keywords—Spring peeper Pseudacris crucifer Pesticide Extinction

INTRODUCTION

Recent concerns have been expressed regarding an apparent global decline of amphibians, and effects of environmental contamination have been suggested as a possible cause [1–4]. Amphibians play an important role in aquatic and terrestrial food webs by acting as both prey and predator [5], and they constitute a major portion of the total community biomass [6]. Characteristics of amphibian physiology and natural history may make them ideal bioindicators of ecosystem health [7]. However, the impact of environmental contaminants on amphibians has received limited attention [8].

Organochlorine pesticide use in North America has decreased since the 1970s, but pesticides may still pose a threat to biota because of their toxicity, environmental persistence, and tendency to bioaccumulate in food chains [9]. The historic application of DDT to wetlands for mosquito control may be of great importance in affecting amphibian populations [10]. At Point Pelee National Park, Canada, DDT was frequently applied until 1967 for mosquito control (park records). Since 1972, three species of amphibians have become locally extinct, and a fourth species has been reduced in abundance in the park. In 1993, we analyzed northern spring peepers (Pseudacris [formerly Hyla] crucifer) to determine the levels of organochlorine pesticide residues persisting 26 years after DDT use has ceased.

MATERIALS AND METHODS

Sample collection

Seven northern spring peepers (Pseudacris crucifer) were collected at Point Pelee National Park, Ontario, Canada in April 1993. Each peeper was wrapped in hexane-rinsed aluminum foil and stored at −20°C until preparation for gas chromatographic (GC) analysis.

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Table 1. Means and standard errors (SE) of pesticide concentrations (µg/kg wet wt.) measured in spring peepers

<table>
<thead>
<tr>
<th>Pesticide</th>
<th>Mean</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>α-HCH</td>
<td>0.37</td>
<td>0.069</td>
</tr>
<tr>
<td>β-HCH</td>
<td>1.37</td>
<td>0.449</td>
</tr>
<tr>
<td>γ-HCH</td>
<td>ND</td>
<td></td>
</tr>
<tr>
<td>Oxychlordane</td>
<td>1.74</td>
<td>0.185</td>
</tr>
<tr>
<td>trans-Chlordane</td>
<td>0.11</td>
<td>0.040</td>
</tr>
<tr>
<td>cis-Chlordane</td>
<td>0.08</td>
<td>0.038</td>
</tr>
<tr>
<td>trans-Nonachlor</td>
<td>0.73</td>
<td>0.082</td>
</tr>
<tr>
<td>cis-Nonachlor</td>
<td>ND</td>
<td></td>
</tr>
<tr>
<td>Heptachlor epoxide</td>
<td>1.98</td>
<td>0.544</td>
</tr>
<tr>
<td>Dieldrin</td>
<td>199.82</td>
<td>133.922</td>
</tr>
<tr>
<td>p,p'-DDT</td>
<td>160.57</td>
<td>98.778</td>
</tr>
<tr>
<td>p,p'-DDE</td>
<td>1,001.14</td>
<td>531.526</td>
</tr>
<tr>
<td>p,p'-DDD</td>
<td>26.49</td>
<td>14.804</td>
</tr>
<tr>
<td>Mirex</td>
<td>ND</td>
<td></td>
</tr>
<tr>
<td>Photo-mirex</td>
<td>ND</td>
<td></td>
</tr>
</tbody>
</table>

ND, values below detection limit.
of organochlorine pesticides observed in amphibians 26 years after cessation of application, it is possible that these pesticides have played a role in the local decline of amphibians. The World Health Organization [26] recognizes that the effects of DDT are quite often remote in time from its application. Although applied historically, the role of DDT and other organochlorine pesticides in affecting amphibian communities should not be overlooked and warrants further consideration.

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REFERENCES