
*BRIEF NOTE*EFFECTS OF DIQUAT ON AMPHIBIAN EMBRYO DEVELOPMENT¹

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Diquat (1:1'-ethylene-2:2'-dipyridylum dibromide) has been extensively applied to aquatic communities with little consideration of its toxicity to the aquatic fauna (Bimber *et al* 1976; May *et al* 1973; Nicholson and Clerman 1974). In a preliminary series of experiments, we have evaluated the possible influence of the herbicide on the development of the eggs of *Rana pipiens*. The initial concentration of 100 ppm was chosen so that any embryological pathology would be obvious to the observer. Field application concentrations of 1-5 ppm are normally used during aquatic weed control efforts, but local concentrations may significantly exceed the recommended dosages.

Females of at least 74 mm body length and males of at least 70 mm body length were used to insure that proper reproductive age criteria had been met. Ovulation was induced utilizing methods developed by Wright and Flathers (1961). Approximately 1200 eggs were divided into the 4 groups indicated in table 1. Fertilization was performed as described by Rugh (1962), except when 100 ppm Diquat was added to a portion of the

sperm suspensions. Static bioassays were conducted at 18°C under subdued lighting conditions in an environmental chamber. A ratio of 25 eggs/liter of test solution was used during the incubation period and the incubation media were changed daily. Tests were terminated after 21 days. During the experiments, dead specimens were removed and de-jellied (if necessary) in 5% chlorox prior to staging (Shumway 1940).

All groups showed reduced viability which we attributed to inducing ovulation in January and February of the year (Wright 1945; Wright and Flathers 1961). Fertilization efficiency was somewhat reduced when Diquat was added to the sperm suspensions but not to a statistically significant level (table 1). Little difference was observed in the survivorship of the test subjects and controls prior to hatching (approx. 7 days). However, none of the tadpoles subjected to Diquat, either during fertilization or later development, survived beyond 14 days after hatching. The frequency of exogastrulation appeared to be elevated in both groups incubated in Diquat during development. Our data indicate that although the eggs of *R. pipiens* were rela-

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TABLE 1
Survival of frog embryos exposed to Diquat (100 ppm).

	Sample Size	% Survival to Each Developmental Stage				
		Morula	Gastrula	Hatch	14 Days Post-hatch	Exogastrulation
Controls	182	54	29	9	7	5
NF/DQ*	196	47	30	8	0	11
DF/Norm**	81	41	33	3	0	5
DF/DQ†	108	44	23	6	0	7

*NF/DQ= Normal fertilization, Diquat present throughout development.

**DF/Norm= Diquat present during fertilization only.

†DF/DQ= Diquat present during fertilization and development.

tively insensitive to the Diquat concentration (100 ppm) used in this study, increased rates of exogastrulation and mortality may occur. The mechanism of this toxicity/teratogenesis is currently unknown and should be the object of future investigation.

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