Persistence in Water of Formulations of the Insect Developmental Inhibitor
ZR515[1]

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The use of developmental inhibitors for insect control is attractive because of their relatively selective toxic properties. ZR515 (Altosid, isopropyl 11-methoxy-3, 7, 11-trimethyldodeca-2, 4-dienoate) has shown promise against mosquito larvae (SCHAEFER and WILDER, 1972; HENRICK et al., 1973), house flies (CERF and GEORGHIOU, 1972) and stable flies (WRIGHT et al., 1973). However, the reported instability of this juvenile hormone analogue in the environment may limit its practical use. SCHAEFER and DUPRAS (1973), using GLC methods, found that residues reached the non-detectable level in water after 24 hrs and SCHAEFER and WILDER (1972) found ZR515 biologically active against *Aedes nigromaculis* (Ludlow) for several days in the field. However, in contrast WRIGHT and BOWMAN (1973) found residues of ZR515 persisting in a stable fly larval medium for over 22 days and we have found residues persisting for up to several weeks in sand in the laboratory. Because of the apparent conflict in findings, we have examined the stability of 2 formulations of ZR515 in fresh and salt water under various conditions in the laboratory.

MATERIALS AND METHODS

Stability determinations were made using a 4-lb A.I. per gallon (U.S.) E.C., and a 10% flowable liquid micro encapsulated (slow release) formulation. Fresh water (pH 5.5) was obtained from a non-tidal area of a stream adjacent to the Research Station at Kentville, N. S. Salt water (pH 7.4) was obtained during incoming tides on the Bay of Fundy at Harbourville, N. S.

Suspensions of approximately 1,000 ppm (based on the trans isomer) were prepared from the E.C. and flowable liquid formulations of ZR515. All test solutions, prepared in duplicate at room temperature, were held in

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stoppered, foil covered, 1 *l* volumetric flasks. One flask was placed in a refrigerator at 4.5°C and the second in a room held at 20°C.

Determination of ZR515

Suspensions were shaken vigorously before aliquots were removed. Aliquots (10 ml) were diluted to 500 ml with distilled water and 5 ml of a saturated KCl solution added. The aqueous phase was extracted by shaking for 5 minutes with 100 ml of hexane in a separatory funnel. The hexane fraction was washed with an additional 200 ml aliquot of distilled water and dried over anhydrous Na_2SO_4, then concentrated under vacuum to about 1 ml and transferred to a graduated tube. The remaining hexane was evaporated and an appropriate volume of analytical grade hexane added. Residues of ZR515 were analyzed with a MicroTek 220 gas chromatograph using a flame-ionization detector. The column was 6 ft x 1/4 in pyrex glass packed with 3% OV-17 on Gas Chrom Q, 100/120 mesh. The carrier gas was nitrogen at a flow rate of 65 cc per minute and the oven temperature was 203°C.

Recovery of ZR515 (measured in terms of the trans isomer) from water ranged from 92 to 98% (based on 4 replications using ZR515 technical). Retention time was 5.8 minutes for the cis isomer and 6.3 minutes for the trans isomer (Fig. 1). The limit of this detection system was estimated to be <50 nanograms. The cis: trans ratio of the 62% trans technical standard was about 1:4 whereas in the EC and flowable liquid the ratio was about 1:3.3 and 1:30 respectively.

RESULTS AND DISCUSSION

Initial suspensions of ZR515 E.C. made up at approximately 1,000 ppm trans isomer persisted for 134 days at 4.5°C in both fresh and salt water, whereas at 20°C they persisted for 49 days in both fresh and salt water (Fig. 2). ZR515 E.C. was more persistent (at 4.5°C) in salt water than in fresh water. At 4.5°C the half-life in salt water was approximately 100 days whereas in fresh water the half-life was approximately 35 days. SCHAEFER and DUPRAS (1973) also showed that ZR515 was more rapidly degraded in water at higher temperatures than at lower temperatures.

The flowable liquid (slow release) formulation was more persistent than the E.C. formulation (Table 1). At 20°C the flowable liquid formulation was degraded at approximately the same rate as the E.C. formulation at 4.5°C. Degradation at 20°C proceeded faster in fresh water than in salt water. At 4.5°C there was some

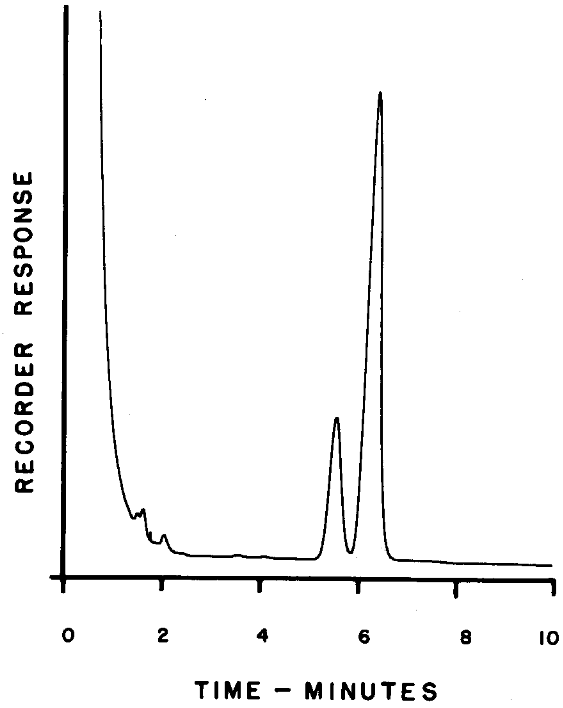

Figure 1. Gas chromatogram of technical ZR515 on a 6 ft 3% OV-17 column at 203°C. Retention time of cis isomer 5.8 min, trans isomer 6.3 min.

scatter in the data, but persistence was greater than at 20°C. The cis:trans isomer ratio was not affected when either the E.C. formulation or the flowable liquid formulation was used. SCHAEFER and DUPRAS (1973) found that ZR515 technical exposed to sunlight isomerized to a 1:1 ratio between the cis and trans isomers.

The data indicate that ZR515 formulations are relatively stable in aqueous mixtures in the absence of sunlight. While the flowable liquid (microencapulated) formulation was more persistent than the E.C. formulation, degradation of both formulations occurred faster at the higher (20°C) temperature. However, at each temperature ZR515 was more persistent in salt water than in fresh water. Whether this was due to the salt content of the water or to pH difference (7.4 in salt water vs. 5.5 for fresh water) and whether ZR515 will persist longer in the field in salt vs. fresh water, i.e. for the control of salt marsh mosquitoes, requires further study.

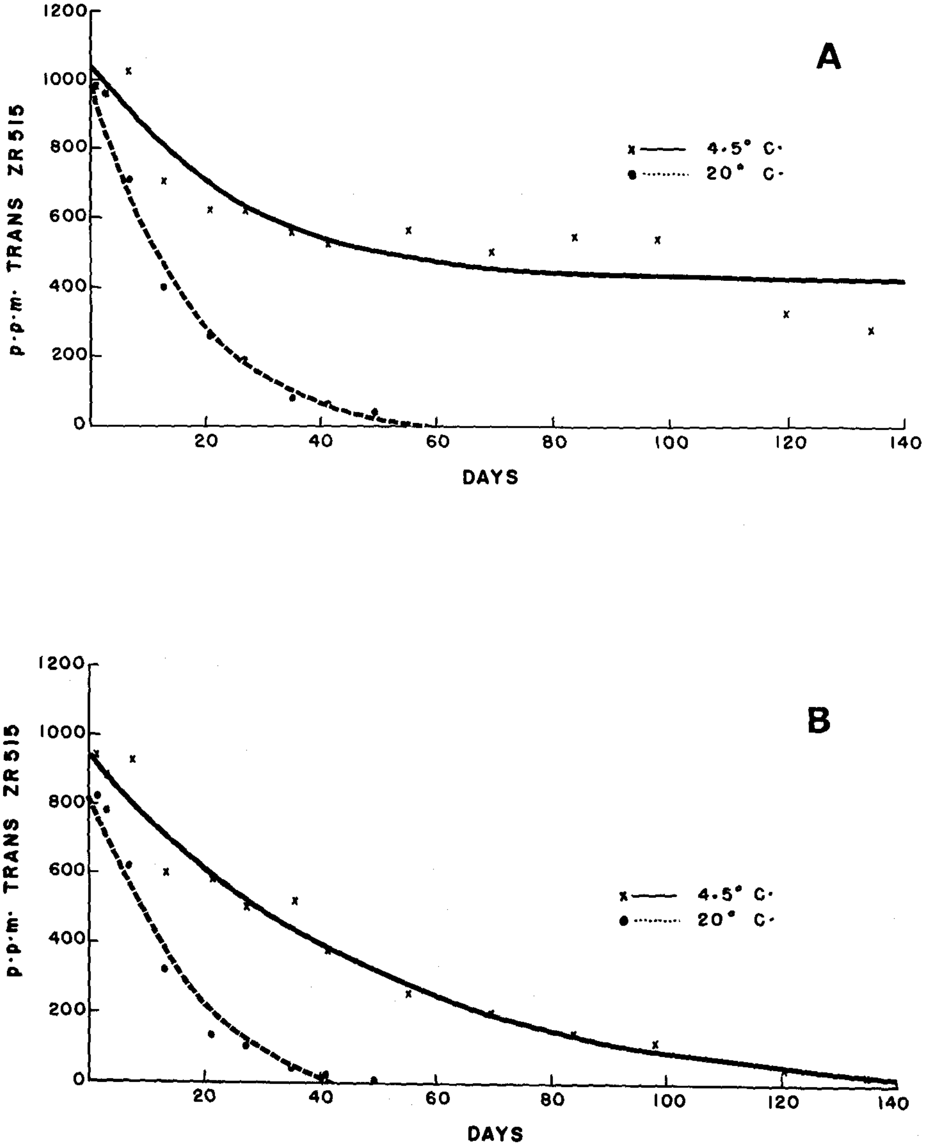

Figure 2. Persistence of ZR515 E.C. in water
A. Salt water, B. Fresh water

TABLE 1

Persistence of ZR515 flowable liquid formulation in water

Days	Sea water		Fresh water	
	4.5°C	20°C	4.5°C	20°C
0	830 ppm[1]	830 ppm	763 ppm	763 ppm
1	713	664	770	-
3	628	702	650	577
7	636	597	689	584
14	644	570	576	586
28	736	568	721	460
35	697	332	696	392
42	731	302	790	326
56	724	252	746	306
70	724	216	680	198
105	804	156	865	88
132	840	124	650	16

[1] Trans isomer

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