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**INSECTICIDE RESISTANCE IN PHTHORIMAEA  
OPERCULELLA (ZELL.): COMPARATIVE RESPONSES TO  
DDT, DDD, ENDRIN, DIELDRIN, ISOBENZAN, LINDANE  
AND AZINPHOS-ETHYL**

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**SUMMARY**

Low-level resistance to lindane and isobenzan and higher level resistance to DDT, DDD, endrin and dieldrin were indicated. No resistance to azinphos-ethyl was shown.

DDT and endrin resistance in *Phthorimaea operculella* (Zell.) has been reported from Queensland by Champ and Shepherd (1965a). Using methods for topical testing of adults described in that text, the comparison of the responses of DDT-endrin susceptible and resistant females to DDT, DDD, endrin, dieldrin, isobenzan, lindane and azinphos-ethyl given in Table 1 was established. Technical grade active ingredients were used to formulate test solutions.

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TABLE 1  
APPARENT CROSS-RESISTANCES IN DDT-ENDRIN RESISTANT *Phthorimaea operculella*

	Median Dose ( $\mu\text{g}$ )			Regression Coefficient	Heterogeneity Factor and Degree of Freedom	Resistance Factor at Median Dose	Maximum Dose Tested any Survival ( $\mu\text{g}$ ) and Corresponding % Mortality	Minimum Dose 100% Mortality ( $\mu\text{g}$ ) and No. of Individuals Used
	Upper Limit (0.05)	Estimate	Lower Limit (0.05)					
<i>DDT</i> —								
DDT—endrin susceptible ..	0.154	0.113	0.076	$2.54 \pm 0.42$	0.73 (3)	..	0.5 (85)	1.0 (12)
DDT—endrin resistant .. ..	100.4	38.5	22.1	$1.16 \pm 0.15$	0.44 (6)	340	100.0 (82)	n.a.
<i>DDD</i> —								
DDT—endrin susceptible ..	0.34	0.21	0.10	$2.52 \pm 0.55$	0.58 (2)	..	1.0 (89)	2.0 (10)
DDT—endrin resistant .. ..	19.1	9.4	5.1	$1.11 \pm 0.21$	0.99 (6)	44.8	50.0 (82)	100.0 (11)
<i>Endrin</i> —								
DDT—endrin susceptible ..	0.017	0.010	0.005	$2.25 \pm 0.74$	0.66 (2)	..	0.05 (90)	0.1 (10)
DDT—endrin resistant .. ..	..	0.72	..	$3.51 \pm 1.21$	1.45 (3)	75.3	1.00 (70)	2.0 (10)
<i>Dieldrin</i> —								
DDT—endrin susceptible ..	0.069	0.048	0.025	$3.25 \pm 0.32$	0.12 (2)	..	0.1 (80)	0.2 (10)
DDT—endrin resistant .. ..	..	7.6	..	$3.05 \pm 1.41$	2.87 (3)	152	20.0 (70)	n.a.
<i>Isobenzan</i> —								
DDT—endrin susceptible ..	0.024	0.016	0.009	$5.43 \pm 0.39$	0.04 (1)	..	0.02 (67)	0.05 (10)
DDT—endrin resistant .. ..	..	0.23	..	$2.08 \pm 1.53$	6.26 (3)	14.4	1.00 (80)	2.00 (10)
<i>Lindane</i> —								
DDT—endrin susceptible ..	..	0.02	..	$3.45 \pm 1.13$	1.40 (2)	..	0.02 (44)	0.05 (12)
DDT—endrin resistant .. ..	0.67	0.17	0.06	$2.69 \pm 0.84$	3.52 (5)	8.5	1.00 (93)	n.a.
<i>Azinphos-ethyl</i> —								
DDT—endrin susceptible ..	..	0.037	..	$6.77 \pm 0.58$	0.02 (2)	..	0.050 (77)	0.075 (14)
DDT—endrin resistant .. ..	..	0.048	..	$6.34 \pm 2.25$	1.94 (3)	..	0.075 (92)	0.100 (20)

n.a.=Not available

A general increase in heterogeneity in responses of the resistant strain to all materials was recorded except for DDT. An examination of Figures 1-3 in the earlier report (Champ and Shepherd 1965a) indicates that fitting a log-probit regression line is inappropriate for DDT and the resistant strains used, and that the low heterogeneity of the data here was fortuitous. In fact, there was significant deviation from the simple dose-mortality relationship with most materials used—use of the relationship was a matter of expediency to demonstrate the order of resistance and the greater spread of the distribution of tolerances in the resistant strain.

Low-level resistance to lindane and isobenzan and higher level resistance to DDT and dieldrin were indicated. Resistance to dieldrin was highest—this material was included in recommendations before 1954 for the treatment of the tobacco pest complex before endrin came into general use (Smith 1954). A common resistance to these stereoisomers is probable; this has not been checked. Lindane and isobenzan may also fall in this category. Lindane has not been recommended for control of *P. operculella* and would have been used rarely in the field; isobenzan was used extensively from 1960 (Smith and Saunders 1960) until replaced by azinphos-ethyl in 1963 (Saunders 1963a, 1963b). DDD has never been used extensively against *P. operculella*; again this resistance is probably a cross-resistance to DDT as commonly observed with other species.

No resistance to azinphos-ethyl was indicated as previously (Champ and Shepherd 1965 a), but the increased heterogeneity of these data from adult material is in accord with an increase in larval tolerance reported at extreme mortalities and larval weights (Champ and Shepherd 1965b).

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