Table 4.5 Genetic and related effects of DDT in non-human mammals in vitro

Species	Tissue, cell line	End-point	Test	Results		Dose (LEC or HIC)	Comments	Reference
				Without metabolic activation	With metabolic activation			
Rat	Primary hepatocytes	DNA damage	Alkaline elution	–	NT	106 µg/mL	DDT	Sina et al. (1983)
Rat	Primary hepatocytes	DNA damage	UDS assay	–	NT	35 µg/mL	DDT	Probst et al. (1981)
Rat	Primary hepatocytes	DNA damage	UDS assay	–	NT	35 µg/mL	DDT	Maslansky & Williams (1981)
Mouse	Primary hepatocytes	DNA damage	UDS assay	–	NT	35 µg/mL	DDT	Maslansky & Williams (1981)
Mouse, Balb/c	Primary hepatocytes	DNA damage	UDS assay	–	NT	35 µg/mL	*p,p′*-DDT	Klaunig et al. (1984)
Chinese hamster	Primary hepatocytes	DNA damage	UDS assay	–	NT	35 µg/mL	DDT	Maslansky & Williams (1981)
Chinese hamster	V79 cells	DNA damage	Alkaline elution	–	–	354 µg/mL	DDT	Swenberg et al. (1976)
Chinese hamster	V79 cells	DNA damage	Alkaline elution	–	–	1060 µg/mL	DDT	Swenberg (1981)
Rat	Liver epithelial cells	Mutation	ARL/HGPRT assay	–	NT	NR	DDT	Telang et al. (1981)
Rat, Fisher	Primary hepatocytes	Mutation	Host-mediated assay (in vitro)	–	NT	10^{-4} M	DDT	Tong et al. (1981)
Mouse	Balb/c 3T3 fibroblasts	Mutation	Cell transformation assay	+	+	10 µg/mL	DDT	Fitzgerald et al. (1989)
Mouse	Embryo cells	Mutation	Cell transformation assay	–	NT	15 µg/mL	*p,p′*-DDT	Langenbach & Gingell (1975)
Chinese hamster	V79 cells	Mutation	*Hprt* mutation assay	–	NT	14.2 µg/mL	*p,p′*-DDT	Tsushimoto et al. (1983)
Chinese hamster	V79 cells	Mutation	*Hprt* mutation assay	–	NT	35 µg/mL	*p,p′*-DDT	Kelly-Garvert & Legator (1973)

Table 4.5 Genetic and related effects of DDT in non-human mammals in vitro

Species	Tissue, cell line	End-point	Test	Results		Dose (LEC or HIC)	Comments	Reference
				Without metabolic activation	With metabolic activation			
Chinese hamster	V79 cells	Mutation	6-thioguanine (6-TO) resistance assay	–	NT	14.2 µg/mL	*p,p'*-DDT	Tsushimoto et al. (1983)
			Diphtheria toxin *(DT)* resistance assay	–	NT	14.2 µg/mL	*p,p'*-DDT	
Rat, kangaroo *Potorous tridactylis aplicalis*	Aneuploid established cell line	Chromosomal damage	Chromosomal aberrations	+	NT	10 µg/mL	*p,p'*-DDT	Palmer et al. (1972)
				+	NT	10 µg/mL	*o,p'*-DDT	
Chinese hamster	V79 cells	Chromosomal damage	Chromosomal aberrations	–	NT	45 µg/mL	*p,p'*-DDT	Kelly-Garvert & Legator (1973)
Chinese hamster	B14 F28 cells	Chromosomal damage	Chromosomal aberrations	+	NT	49 µg/mL × 4h	*p,p'*-DDT	Mahr & Miltenburger (1976)
Rabbit, New Zealand White	Lymphocytes	Chromosomal damage	Chromosomal aberrations	–	NT	100 µg/mL	*p, p'*-DDT	Hart et al. (1972)
Artic beluga whale *Delphinapterus leucas*	Skin fibroblasts	Chromosomal damage	Micronucleus formation	+	–	10 µg/mL	*p, p'*-DDT	Gauthier et al. (1999)

+, positive; –, negative; DDT, dichlorodiphenyltrichloroethane; HIC, highest ineffective concentration; LEC, lowest effective concentration, NT, not tested; UDS, unscheduled DNA synthesis

Table 4.6 Genetic and related effects of metabolites of DDT in non-human mammalian cells in vitro

Species	Tissue, cell line	End-point	Test	Results		Concentration (LEC or HIC)	Comments	Reference
				Without metabolic activation	With metabolic activation			
Rat	Primary hepatocytes	DNA damage	Alkaline elution	+	NT	95 µg/mL	*p,p′*-DDE	Sina et al. (1983)
Rat	Primary hepatocytes	DNA damage	UDS assay	–	NT	31 µg/mL	DDE	Maslansky & Williams (1981)
Rat	Primary hepatocytes	DNA damage	UDS assay	–	NT	2000 µg/mL	*p,p′*-DDE	Williams et al. (1982)
Mouse	Primary hepatocytes	DNA damage	UDS assay	–	NT	31 µg/mL	DDE	Maslansky & Williams (1981)
Mouse	Embryo cells	Mutation	Cell transformation assay	–	NT	15 µg/mL	*p,p′*-DDE	Langenbach & Gingell (1975)
Mouse	L5178Y mouse lymphoma cells	Mutation	TK mutation assay	+	+	30 µg/mL	*p,p′*-DDE	Clive et al. (1979)
Mouse	L5178Y mouse lymphoma cells	Mutation	TK mutation assay	+	NT	25 µg/mL	*p,p′*-DDE	McGregor et al. (1988)
Mouse	L5178Y mouse lymphoma cells	Mutation	*Hprt* mutation assay	+	NT	16 µg/mL	*p,p′*-DDE	Amacher & Zelljadt (1984)
Chinese hamster	Wild-type V79 cells ($6TG^s$) and a 6TG-resistant clone, T2–14 cells ($6TG^r$)	Mutation	Inhibition of metabolic cooperation assay	+	NT	10 µg/mL	DDE	Kurata et al. (1982)
				+	NT	2.5 µg/mL	TDE	

Table 4.6 Genetic and related effects of metabolites of DDT in non-human mammalian cells in vitro

Species	Tissue, cell line	End-point	Test	Results		Concentration (LEC or HIC)	Comments	Reference
				Without metabolic activation	With metabolic activation			
Chinese hamster	V79 cells	Mutation	*Hprt* mutation assay	+	NT	25 µg/mL	*p,p'*-DDE	Kelly-Garvert & Legator (1973)
Rat, kangaroo *Potorous tridactylis aplicalis*	Aneuploid established cell line	Chromosomal damage	Chromosomal aberrations	+	NT	10 µg/mL	*p,p'*- DDE	Palmer et al. (1972)
				+	NT	10 µg/mL	*o,p'*-DDE	
				+	NT	10 µg/mL	*p,p'*-DDD	
				+	NT	10 µg/mL	*o,p'*-DDD	
				–	NT	100 µg/mL	*p,p'*- DDA	
Chinese hamster	V79 cells	Chromosomal damage	Chromosomal aberrations	+	NT	35 µg/mL	*p,p'*-DDE	Kelly-Garvert & Legator (1973)
Chinese hamster	CHO cells	Chromosomal damage	Chromosomal aberrations	–	–	60 µg/mL	DDE	Galloway et al. (1987)
			Sister-chromatid exchanges	–	(+)	5 µg/mL	DDE	
Chinese hamster	B14 F28 cells	Chromosomal damage	Chromosomal aberrations	+	NT	44 µg/mL × 4 h	*p,p'*-DDE	Mahr & Miltenburger (1976)
				+	NT	41 µg/mL × 4 h	*p,p'*-DDA	
				–	NT	75 µg/mL × 4 h	*p,p'*-DDD	

+, positive; –, negative; DDA, 2,2-bis(4-chlorophenyl)-acetic acid; DDD, dichlorodiphenyldichloroethane; DDE, dichlorodiphenyldichloroethylene; DDT, dichlorodiphenyltrichloroethane; HIC, highest ineffective concentration; LEC, lowest effective concentration, NT, not tested; TDE, 1,1-dichloro-2,2-bis(*p*-chlorophenyl)ethane; UDS, unscheduled DNA synthesis

Table 4.7 Genetic and related effects of DDT in non-mammalian systems

Phylogenetic class	Species, strain, tissue	End-point	Test	Results		Concentration (LEC or HIC)	Comments	Reference
				Without metabolic activation	With metabolic activation			
Invertebrates	Zebra mussel, *Dreissena polymorpha*	Chromosomal damage	Micronucleus formation	+	NA	0.1 µg/L for 168 h	*p,p′*-DDT	Binelli et al. (2008b)
	Shrimp, *Litopenaeus stylirostris*	DNA damage	DNA adducts	+	NA	Sublethal concentration NR	Exposed to DDT for 4 days; DDT replaced daily and dead larvae removed	Galindo Reyes et al. (2002)
	Shrimp, *Litopenaeus stylirostris*	DNA damage	DNA strand breaks	+	NA	Sublethal concentration NR	Exposed to DDT for 4 days; DDT replaced daily and dead larvae removed	Galindo Reyes et al. (2002)
Insects	*Drosophila melanogaster y/R(1)2,vf/B^5 Yy$^+$*, male, germ-line cells	Chromosomal damage	Chromosomal aberrations	+	NA	1 µg, in feeding media	Formulation (*p,p′*-DDT, 80%; *o,p′*-DDT, 18%; *p,p′*-DDE, 2%)	Clark (1974)
	Drosophila melanogaster y/R(1)2,vf/B^5 Yy$^+$, male, germ-line cells	Chromosomal damage	Chromosomal aberrations	–	NA	25 ppm, in feeding media	Formulated product of DDT not specified	Woodruff et al. (1983)
	Drosophila melanogaster, male, somatic cells	Mutation	*Accord* insertion	+	NA	NT	DDT	Catania et al. (2004)
	Drosophila melanogaster Canton-*S*, male, germ-line cells	Mutation	Dominant lethal	+	NA	1 µg, in feeding media	Formulation (*p,p′*-DDT, 80%; *o,p′*-DDT, 18%; *p,p′*-DDE, 2%)	Clark (1974)
	Drosophila melanogaster, male, germ-line cells	Mutation	Sex linked recessive lethal	±	NA	0.14 mM, , in feeding media	DDT	Vogel (1972)
	Drosophila melanogaster, male, germ-line cells, germ-line cells	Mutation	Sex linked recessive lethal	–	NA	20 µg, in feeding media	*p,p′*-DDT	Pielou (1952)

Table 4.7 Genetic and related effects of DDT in non-mammalian systems

Phylogenetic class	Species, strain, tissue	End-point	Test	Results		Concentration (LEC or HIC)	Comments	Reference
				Without metabolic activation	With metabolic activation			
	Drosophila melanogaster Canton-*S*, male, germ-line cells	Mutation	Sex linked recessive lethal	–	NA	20 µg/week, in feeding media up to 8 mo	Formulation (*p,p′*-DDT, 80%; *o,p′*-DDT, 18%; *p,p′*-DDE, 2%)	Clark (1974)
Lower eukaryote (yeast, mould, fungi)	*Saccharomyces cerevisiae*	Mutation	Mitotic gene conversion	–	NT	NR	DDT	Fahrig (1974)
	Saccharomyces cerevisiae D61.M	Mutation	Colony formation assay	–	–	0.140 mM	*p,p′*-DDT	Albertini et al. (1988)
	Saccharomyces cerevisiae D61.M	Chromosomal damage	Chromosomal loss assay	–	–	0.140 mM	*p,p′*-DDT	Albertini et al. (1988)
	Aspergillus nidulans haploid strain 35	Mutation	Forward mutation	–	NT	2.8 mM	*p,p′*-DDT	Crebelli et al. (1986)
	Aspergillus nidulans diploid strain P1	Chromosomal damage	Aneuploidy	–	NT	2.8 mM	*p,p′*-DDT	Crebelli et al. (1986)
	Neurospora crassa heterokaryon 12	Mutation	Host-mediated assay (in vivo)	–	NT	75 mg/mL	Formulation (*p,p′*-DDT, 80% ; *o,p′*-DDT, 18%; *p,p′*-DDE, 2%)	Clark (1974)
	Neurospora crassa heterokaryon 12	Mutation	Host-mediated assay (in vitro)	±	NT	75 mg/mL	Formulation (*p,p′*-DDT, 80% ; *o,p′*-DDT, 18%; *p,p′*-DDE, 2%) Inconclusive results	Clark (1974)
	Tetrahymena thermophila Cu428	Toxicogenomics	Gene expression	+	NA	4×10^{-6} mol/L per 24 h	DDT	Chang et al. (2011)

Table 4.7 Genetic and related effects of DDT in non-mammalian systems

Phylogenetic class	Species, strain, tissue	End-point	Test	Results		Concentration (LEC or HIC)	Comments	Reference
				Without metabolic activation	With metabolic activation			
Prokaryote (bacteria)	*Salmonella typhimurium* TA92	Mutation	Reverse mutation	NT	–	1000 µg/plate	DDT	Glatt & Oesch (1987)
	Salmonella typhimurium TA98	Mutation	Reverse mutation	–	–	500 µg/plate	DDT	De Flora et al. (1989)
	Salmonella typhimurium TA98	Mutation	Reverse mutation	–	–	2500 µg/plate	DDT	Byeon et al. (1976)
	Salmonella typhimurium TA98	Mutation	Reverse mutation	–	–	170 µg/plate	DDT	Bartsch et al. (1980)
	Salmonella typhimurium TA98	Mutation	Reverse mutation	–	–	177 µg/plate	DDT	Nishimura et al. (1982)
	Salmonella typhimurium TA98	Mutation	Reverse mutation	–	–	370 µg/plate	DDT	Van Dijck & Van de Voorde (1976)
	Salmonella typhimurium TA98	Mutation	Reverse mutation	–	–	500 µg/plate	DDT	Bruce & Heddle (1979)
	Salmonella typhimurium TA98	Mutation	Reverse mutation	–	–	35 µg/plate	DDT	Probst et al. (1981)
	Salmonella typhimurium TA98	Mutation	Reverse mutation	NT	–	2500 µg/plate	DDT	Simmon et al. (1977)
	Salmonella typhimurium TA98	Mutation	Reverse mutation	NT	–	1000 µg/plate	DDT	Glatt & Oesch (1987)
	Salmonella typhimurium TA98	Mutation	Reverse mutation	–	–	5000 µg/plate	*p,p'*-DDT	Moriya et al. (1983)
	Salmonella typhimurium TA98	Mutation	Reverse mutation	–	–	177 µg/plate	*p,p'*-DDT	Planche et al. (1979)

Table 4.7 Genetic and related effects of DDT in non-mammalian systems

Phylogenetic class	Species, strain, tissue	End-point	Test	Results		Concentration (LEC or HIC)	Comments	Reference
				Without metabolic activation	With metabolic activation			
	Salmonella typhimurium TA100	Mutation	Reverse mutation	–	–	35 µg/plate	DDT	Probst et al. (1981)
	Salmonella typhimurium TA100	Mutation	Reverse mutation	–	–	370 µg/plate	DDT	Van Dijck & Van de Voorde (1976)
	Salmonella typhimurium TA100	Mutation	Reverse mutation	–	–	177 µg/plate	DDT	Nishimura et al. (1982)
	Salmonella typhimurium TA100	Mutation	Reverse mutation	–	–	170 µg/plate	DDT	Bartsch et al. (1980)
	Salmonella typhimurium TA100	Mutation	Reverse mutation	–	–	500 µg/plate	DDT	De Flora et al. (1989)
	Salmonella typhimurium TA100	Mutation	Reverse mutation	–	–	2500 µg/plate	DDT	Byeon et al. (1976)
	Salmonella typhimurium TA100	Mutation	Reverse mutation	–	–	500 µg/plate	DDT	Bruce & Heddle (1979)
	Salmonella typhimurium TA100	Mutation	Reverse mutation	NT	–	1000 µg/plate	DDT	Glatt & Oesch (1987)
	Salmonella typhimurium TA100	Mutation	Reverse mutation	NT	–	2500 µg/plate	DDT	Simmon et al. (1977)
	Salmonella typhimurium TA100	Mutation	Reverse mutation	–	–	5000 µg/plate	*p,p′*-DDT	Moriya et al. (1983)
	Salmonella typhimurium TA100	Mutation	Reverse mutation	–	–	177 µg/plate	*p,p′*-DDT	Planche et al. (1979)
	Salmonella typhimurium TA1535	Mutation	Reverse mutation	–	–	35 µg/plate	DDT	Probst et al. (1981)

Table 4.7 Genetic and related effects of DDT in non-mammalian systems

Phylogenetic class	Species, strain, tissue	End-point	Test	Results		Concentration (LEC or HIC)	Comments	Reference
				Without metabolic activation	With metabolic activation			
	Salmonella typhimurium TA1535	Mutation	Reverse mutation	–	–	2500 µg/plate	DDT	Byeon et al. (1976)
	Salmonella typhimurium TA1535	Mutation	Reverse mutation	–	–	2500 µg/plate	DDT	Marshall et al. (1976)
	Salmonella typhimurium TA1535	Mutation	Reverse mutation	–	–	500 µg/plate	DDT	Bruce & Heddle (1979)
	Salmonella typhimurium TA1535	Mutation	Reverse mutation	NT	–	1000 µg/plate	DDT	Glatt & Oesch (1987)
	Salmonella typhimurium TA1535	Mutation	Reverse mutation	NT	–	2500 µg/plate	DDT	Simmon et al. (1977)
	Salmonella typhimurium TA1535	Mutation	Reverse mutation	–	–	5000 µg/plate	*p*,*p*′-DDT	Moriya et al. (1983)
	Salmonella typhimurium TA1536	Mutation	Reverse mutation	–	–	2500 µg/plate	DDT	Marshall et al. (1976)
	Salmonella typhimurium TA1537	Mutation	Reverse mutation	–	–	35 µg/plate	DDT	Probst et al. (1981)
	Salmonella typhimurium TA1537	Mutation	Reverse mutation	–	–	2500 µg/plate	DDT	Marshall et al. (1976)
	Salmonella typhimurium TA1537	Mutation	Reverse mutation	–	–	500 µg/plate	DDT	Bruce & Heddle (1979)
	Salmonella typhimurium TA1537	Mutation	Reverse mutation	NT	–	1000 µg/plate	DDT	Glatt & Oesch (1987)
	Salmonella typhimurium TA1537	Mutation	Reverse mutation	NT	–	2500 µg/plate	DDT	Simmon et al. (1977)
	Salmonella typhimurium TA1537	Mutation	Reverse mutation	–	–	5000 µg/plate	*p*,*p*′-DDT	Moriya et al. (1983)

Table 4.7 Genetic and related effects of DDT in non-mammalian systems

Phylogenetic class	Species, strain, tissue	End-point	Test	Results		Concentration (LEC or HIC)	Comments	Reference
				Without metabolic activation	With metabolic activation			
	Salmonella typhimurium TA1538	Mutation	Reverse mutation	–	–	2500 µg/plate	DDT	Byeon et al. (1976)
	Salmonella typhimurium TA1538	Mutation	Reverse mutation	–	–	35 µg/plate	DDT	Probst et al. (1981)
	Salmonella typhimurium TA1538	Mutation	Reverse mutation	–	–	2500 µg/plate	DDT	Marshall et al. (1976)
	Salmonella typhimurium TA1538	Mutation	Reverse mutation	NT	–	2500 µg/plate	DDT	Simmon et al. (1977)
	Salmonella typhimurium TA1538	Mutation	Reverse mutation	NT	–	1000 µg/plate	DDT	Glatt & Oesch (1987)
	Salmonella typhimurium TA1538	Mutation	Reverse mutation	–	–	5000 µg/plate	*p*,*p*′-DDT	Moriya et al. (1983)
	Salmonella typhimurium TA1978	Mutation	Reverse mutation	–	–	370 µg/plate	DDT	Van Dijck & Van de Voorde (1976)
	Salmonella typhimurium C3076	Mutation	Reverse mutation	–	–	35 µg/plate	DDT	Probst et al. (1981)
	Salmonella typhimurium D3052	Mutation	Reverse mutation	–	–	35 µg/plate	DDT	Probst et al. (1981)
	Salmonella typhimurium G46	Mutation	Reverse mutation	–	–	35 µg/plate	DDT	Probst et al. (1981)
	Escherichia coli Q-13	DNA damage	DNA-cell-binding	NT	–	150 µM	DDT	Kubinski et al. (1981)
	Escherichia coli PQ37	Mutation	SOS chromotest	–	–	1000 µg/mL	DDT	Dayan et al. (1987)

Table 4.7 Genetic and related effects of DDT in non-mammalian systems

Phylogenetic class	Species, strain, tissue	End-point	Test	Results		Concentration (LEC or HIC)	Comments	Reference
				Without metabolic activation	With metabolic activation			
	Escherichia coli WP2 *uvrA*	Mutation	Reverse mutation	–	–	35 µg/plate	DDT	Probst et al. (1981)
	Escherichia coli WP2 *uvrA*	Mutation	Reverse mutation	NT	–	1000 µg/plate	DDT	Glatt & Oesch (1987)
	Escherichia coli WP2 *hcr*	Mutation	Reverse mutation	–	–	5000 µg/plate	*p,p′*-DDT	Moriya et al. (1983)
	Escherichia coli	Mutation	Reverse mutation Pol-A mutation	–	–	500 µg/plate	*p,p′*-DDT	Fluck et al. (1976)
	Bacillus subtilis M 45 Rec^-, H17 Rec^+	Mutation	Rec assay	–	NT	NR	DDT	Shirasu et al. (1976)
	Serratia marcescens	Mutation	Host-mediated assay (in vivo)	–	NT	NR	DDT	Buselmaier et al. (1973)
Acellular systems	Isolated DNA from ColE1 plasmid	DNA damage	DNA single-strand breaks/alkaline labile sites	–	NT	100 µg/mL	DDT	Griffin & Hill (1978)

+, positive; –, negative; ± , equivocal (variable response in several experiments within an adequate study); DDE, dichlorodiphenyldichloroethylene; DDT, dichlorodiphenyltrichloroethane; HIC, highest ineffective concentration; LEC, lowest effective concentration; NA, not applicable; NR, not reported; NT, not tested

Table 4.8 Genetic and related effects of metabolites of DDT in non-mammalian systems in vitro

Phylogenetic class	Species, strain	End-point	Test	Results		Concentration (LEC or HIC)	Comments	Reference
				Without metabolic activation	With metabolic activation			
Prokaryote (bacteria)	*Salmonella typhimurium* TA92	Mutation	Reverse mutation	NT	–	1000 µg/plate	DDE	Glatt & Oesch (1987)
	Salmonella typhimurium TA98	Mutation	Reverse mutation	NT	–	1000 µg/plate	DDE	Glatt & Oesch (1987)
	Salmonella typhimurium TA98	Mutation	Reverse mutation	–	–	500 µg/plate	*p,p'*-DDE	Mortelmans et al. (1986)
	Salmonella typhimurium TA98	Mutation	Reverse mutation	–	–	5000 µg/plate	*p,p'*-DDE	De Flora (1981)
	Salmonella typhimurium TA98	Mutation	Reverse mutation	–	–	860 µg/plate	*p,p'*-DDE	Bartsch et al. (1980)
	Salmonella typhimurium TA98	Mutation	Reverse mutation	–	–	500 µg/plate	*p,p'*-DDE	De Flora et al. (1989)
	Salmonella typhimurium TA98	Mutation	Reverse mutation	–	–	2500 µg/plate	*p,p'*-DDE	Brams et al. (1987)
	Salmonella typhimurium TA98	Mutation	Reverse mutation	–	–	5000 µg/plate	*p,p'*-DDE	Moriya et al. (1983)
	Salmonella typhimurium TA98	Mutation	Reverse mutation	–	–	370 µg/plate	*p,p'*-DDE	Van Dijck & Van de Voorde (1976)
	Salmonella typhimurium TA100	Mutation	Reverse mutation	NT	–	1000 µg/plate	DDE	Glatt & Oesch (1987)
	Salmonella typhimurium TA100	Mutation	Reverse mutation	–	–	500 µg/plate	*p,p'*-DDE	Mortelmans et al. (1986)
	Salmonella typhimurium TA100	Mutation	Reverse mutation	–	–	5000 µg/plate	*p,p'*-DDE	De Flora (1981)

Table 4.8 Genetic and related effects of metabolites of DDT in non-mammalian systems in vitro

Phylogenetic class	Species, strain	End-point	Test	Results		Concentration (LEC or HIC)	Comments	Reference
				Without metabolic activation	With metabolic activation			
	Salmonella typhimurium TA100	Mutation	Reverse mutation	–	–	860 µg/plate	*p,p'*-DDE	Bartsch et al. (1980)
	Salmonella typhimurium TA100	Mutation	Reverse mutation	–	–	500 µg/plate	*p,p'*-DDE	De Flora et al. (1989)
	Salmonella typhimurium TA100	Mutation	Reverse mutation	–	–	2500 µg/plate	*p,p'*-DDE	Brams et al. (1987)
	Salmonella typhimurium TA100	Mutation	Reverse mutation	–	–	5000 µg/plate	*p,p'*-DDE	Moriya et al. (1983)
	Salmonella typhimurium TA100	Mutation	Reverse mutation	–	–	370 µg/plate	*p,p'*-DDE	Van Dijck & Van de Voorde (1976)
	Salmonella typhimurium TA100	Mutation	Reverse mutation	NT	–	2500 µg/plate	*p,p'*-DDE	McCann et al. (1975)
	Salmonella typhimurium TA1535	Mutation	Reverse mutation	–	–	1000 µg/plate	DDE	Marshall et al. (1976)
	Salmonella typhimurium TA1535	Mutation	Reverse mutation	NT	–	1000 µg/plate	DDE	Glatt & Oesch (1987)
	Salmonella typhimurium TA1535	Mutation	Reverse mutation	–	–	500 µg/plate	*p,p'*-DDE	Mortelmans et al. (1986)
	Salmonella typhimurium TA1535	Mutation	Reverse mutation	–	–	5000 µg/plate	*p,p'*-DDE	De Flora (1981)
	Salmonella typhimurium TA1535	Mutation	Reverse mutation	–	–	2500 µg/plate	*p,p'*-DDE	Brams et al. (1987)
	Salmonella typhimurium TA1535	Mutation	Reverse mutation	–	–	5000 µg/plate	*p,p'*-DDE	Moriya et al. (1983)
	Salmonella typhimurium TA1535	Mutation	Reverse mutation	–	–	370 µg/plate	*p,p'*-DDE	Van Dijck & Van de Voorde (1976)

Table 4.8 Genetic and related effects of metabolites of DDT in non-mammalian systems in vitro

Phylogenetic class	Species, strain	End-point	Test	Results		Concentration (LEC or HIC)	Comments	Reference
				Without metabolic activation	With metabolic activation			
	Salmonella typhimurium TA1536	Mutation	Reverse mutation	–	–	1000 µg/plate	DDE	Marshall et al. (1976)
	Salmonella typhimurium TA1537	Mutation	Reverse mutation	–	–	1000 µg/plate	DDE	Marshall et al. (1976)
	Salmonella typhimurium TA1537	Mutation	Reverse mutation	NT	–	1000 µg/plate	DDE	Glatt & Oesch (1987)
	Salmonella typhimurium TA1537	Mutation	Reverse mutation	–	–	500 µg/plate	*p,p'*-DDE	Mortelmans et al. (1986)
	Salmonella typhimurium TA1537	Mutation	Reverse mutation	–	–	5000 µg/plate	*p,p'*-DDE	De Flora (1981)
	Salmonella typhimurium TA 1537	Mutation	Reverse mutation	–	–	2500 µg/plate	*p,p'*-DDE	Brams et al. (1987)
	Salmonella typhimurium TA 1537	Mutation	Reverse mutation	–	–	5000 µg/plate	*p,p'*-DDE	Moriya et al. (1983)
	Salmonella typhimurium TA1537	Mutation	Reverse mutation	–	–	370 µg/plate	*p,p'*-DDE	Van Dijck & Van de Voorde (1976)
	Salmonella typhimurium TA1537	Mutation	Reverse mutation	NT	–	2500 µg/plate	*p,p'*-DDE	McCann et al. (1975)
	Salmonella typhimurium TA1538	Mutation	Reverse mutation	–	–	1000 µg/plate	DDE	Marshall et al. (1976)
	Salmonella typhimurium TA1538	Mutation	Reverse mutation	NT	–	1000 µg/plate	DDE	Glatt & Oesch (1987)
	Salmonella typhimurium TA1538	Mutation	Reverse mutation	–	–	5000 µg/plate	*p,p'*-DDE	De Flora (1981)
	Salmonella typhimurium TA 1538	Mutation	Reverse mutation	–	–	5000 µg/plate	*p,p'*-DDE	Moriya et al. (1983)

Table 4.8 Genetic and related effects of metabolites of DDT in non-mammalian systems in vitro

Phylogenetic class	Species, strain	End-point	Test	Results		Concentration (LEC or HIC)	Comments	Reference
				Without metabolic activation	With metabolic activation			
	Salmonella typhimurium TA1538	Mutation	Reverse mutation	–	–	370 µg/plate	*p,p′*-DDE	Van Dijck & Van de Voorde (1976)
	Salmonella typhimurium TA1538	Mutation	Reverse mutation	NT	–	2500 µg/plate	*p,p′*-DDE	McCann et al. (1975)
	Salmonella typhimurium TA1950	Mutation	Reverse mutation	–	–	370 µg/plate	*p,p′*-DDE	Van Dijck & Van de Voorde (1976)
	Salmonella typhimurium TA1978	Mutation	Reverse mutation	–	–	370 µg/plate	*p,p′*-DDE	Van Dijck & Van de Voorde (1976)
	Salmonella typhimurium TA100	Mutation	Reverse mutation	–	NT	0.10 µg/plate	Metabolite 2,2-bis(*p*-chlorophenyl)-2-chloroacetaldehyde (αC1-DDCHO)	Gold et al. (1981)
	Salmonella typhimurium TA98	Mutation	Reverse mutation	–	+	3.15 µg/plate	Metabolite 1,1-bis(*p*-chlorophenyl)-2,2-dichloroethane was mutagenic when norharman was added to the metabolizing system	Glatt & Oesch (1987)
	Salmonella typhimurium TA100	Mutation	Reverse mutation	+	NT	0.025 µg/plate	Metabolite l-Chloro-2,2-bis(*p*-chlorophenyl)ethene (DDMU)-epoxide	Gold et al. (1981)
	Escherichia coli WP2 *uvrA*	Mutation	Reverse mutation	NT	–	1000 µg/plate	DDE	Glatt & Oesch (1987)
	Escherichia coli WP2 *uvrA*	Mutation	Reverse mutation	NT	–	1000 µg/plate	*p,p′*-DDE	Mamber et al. (1984)

Table 4.8 Genetic and related effects of metabolites of DDT in non-mammalian systems in vitro

Phylogenetic class	Species, strain	End-point	Test	Results		Concentration (LEC or HIC)	Comments	Reference
				Without metabolic activation	With metabolic activation			
	Escherichia coli WP2 *hcr*	Mutation	Reverse mutation	–	–	5000 µg/plate	*p,p'*-DDE	Moriya et al. (1983)
	Escherichia coli Pol-A	Mutation	Reverse mutation	–	–	500 µg/plate	*p,p'*-DDE	Fluck et al. (1976)
	Escherichia coli Pol-A	Mutation	Reverse mutation	–	–	500 µg/plate	*p,p'*-DDD	Fluck et al. (1976)
	Serratia marcescens a21 Leu$^-$	Mutation	Reverse mutation	+	NT	NR	DDD	Buselmaier et al. (1973)
	Serratia marcescens a31 His$^-$	Mutation	Reverse mutation	+	NT	NR	DDD	Buselmaier et al. (1973)
	Serratia marcescens	Mutation	Host-mediated assay (in vivo)	–	NT	NR	DDE	Buselmaier et al. (1973)
	Serratia marcescens	Mutation	Host-mediated assay (in vivo)	–	NT	NR	DDA	Buselmaier et al. (1973)
Lower eukaryote (yeast, mould, fungi)	*Saccharomyces cerevisiae*	Mutation	Mitotic gene conversion	–	NT	NR	DDE	Fahrig (1974)
	Saccharomyces cerevisiae	Mutation	Mitotic gene conversion	–	NT	NR	DDD	Fahrig (1974)
	Saccharomyces cerevisiae	Mutation	Mitotic gene conversion	–	NT	NR	DDA	Fahrig (1974)
	Saccharomyces cerevisiae RS112	Chromosomal damage	Intrachromosomal recombination assay	+	–	100 µg/mL	*p,p'*-DDE	Schiestl (1989); Schiestl et al. (1989)
Invertebrates	Zebra mussel *Dreissena polymorpha*	DNA damage	Comet assay	+	NA	0.1 µg/L for 168 h	*p,p'*-DDE	Binelli et al. (2008a)

Table 4.8 Genetic and related effects of metabolites of DDT in non-mammalian systems in vitro

Phylogenetic class	Species, strain	End-point	Test	Results		Concentration (LEC or HIC)	Comments	Reference
				Without metabolic activation	With metabolic activation			
	Zebra mussel *Dreissena polymorpha*	Chromosomal damage	Micronucleus formation	+	NA	0.1 µg/L for 168 h	*p,p'*-DDE	Binelli et al. (2008a, b)
	Zebra mussel *Dreissena polymorpha*	Chromosomal damage	Micronucleus formation	+	NA	0.1 µg/L for 168 hours	*p,p'*-DDD	Binelli et al. (2008b)
Insects	*Drosophila melanogaster* Canton-*S*, male, germ-line cells	Mutation	Sex-linked recessive lethal	+	NA	10 000 µg/mL, in feeding media	*p,p'*-DDE	Valencia et al. (1985)
	Drosophila melanogaster, male, germ-line cells	Mutation	Sex-linked recessive lethal	+	NA	3.4 mM, in feeding media	DDA	Vogel (1972)
	Drosophila melanogaster, male, germ-line cells	Mutation	Sex-linked recessive lethal	–	NA	3.1 mM, in feeding media	DDE	Vogel (1972)
	Drosophila melanogaster, male, germ-line cells	Mutation	Sex-linked recessive lethal	–	NA	0.3 mM, in feeding media	DDD	Vogel (1972)
	Drosophila melanogaster, male, germ-line cells	Mutation	Sex-linked recessive lethal	–	NA	3.7 mM, in feeding media	DDOM	Vogel (1972)
	Drosophila melanogaster Canton-*S*, male, germ-line cells	Chromosomal damage	Heritable translocation assay	–	NA	10 000 µg/mL, in feeding media	*p,p'*-DDE	Valencia et al. (1985)

+, positive; –, negative; DDA, 2,2,-bis(4-chlorophenyl)-acetic acid; DDD, trichlorodiphenyldichloroethane; DDE, dichlorodiphenyldichloroethylene; DDOM, 2,2-bis(*p*-chlorophenyl-ethane); DDT, dichlorodiphenyltrichloroethane; HIC, highest ineffective concentration; LEC, lowest effective concentration; NA, not applicable; NR, not reported; NT, not tested