[CONTRIBUTION FROM THE LABORATORY OF APPLIED ORGANIC CHEMISTRY, RESEARCH COUNCIL OF ISRAEL]

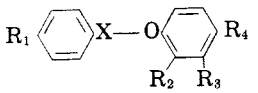
Studies in Selective Toxicity. II. Substituted Phenyl Benzoates and Benzenesulfonates

M. NEEMAN, A. MODIANO, AND Y. SHOR

Received February 17, 1956

Twenty-six phenyl benzoates and benzenesulfonates, mono-, di- or tri-substituted by methyl, chlorine, and/or bromine, have been synthesized and tested for toxicity against larvae of ticks and both eggs and larvae of houseflies. No significant toxicity has been observed.

Substituted phenyl benzoates and benzenesulfonates have been tested as miticides.[1-4] Fifteen new compounds belonging to these classes have been prepared. They have been tested together with eleven previously reported compounds against ticks and the larvae of house flies. The new compounds are substituted by methyl, chlorine, or bromine in one, two, or three positions of A:

A. 

(X = CO or SO_2; R_1, R_2, R_3, R_4 = H, CH_3, Cl, or Br)

The new compounds have been prepared by the usual methods from the appropriate benzoyl or benzenesulfonyl chlorides and phenols.[5]

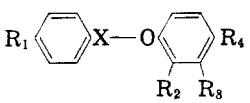
None of the compounds showed significant toxicity when tested by contact of ticks (second stage larvae of *Ornithodorus tholozani*) with residual deposits of the compounds at 1 g. per sq. m. on glass surfaces; or by pre-emergence treatment of the larval rearing medium of houseflies (*Musca domestica vicina* Macq.) with the compounds at 200 p.p.m.

EXPERIMENTAL[6]

Preparation of compounds. Equivalent amounts of the benzoyl or benzenesulfonyl chloride and the phenol were

TABLE I

PHENYL BENZENESULPHONATES (X = SO_2) AND PHENYL BENZOATES (X = CO)



	R_1	R_2	R_3	R_4	Yield, %	M.P., °C. (corr.)	Empirical Formula	Analysis Carbon Calc'd	Carbon Found	Hydrogen Calc'd	Hydrogen Found
		X = CO									
I	CH_3	H	H	Cl	78	91.6–92.1	$C_{14}H_{11}ClO_2$	68.16	68.20	4.50	4.64
II	Cl	H	H	CH_3	85	98 – 98.5	$C_{14}H_{11}ClO_2$	68.16	68.02	4.50	4.83
III	Br	H	H	CH_3	40	118 –118.4	$C_{14}H_{11}BrO_2$	57.75	57.92	3.81	4.21
IV	Cl	H	Cl	H	98	101.5	$C_{13}H_8Cl_2O_2$	58.45	58.48	3.02	2.90
V	Br	H	H	Br	45	114.8–115.4	$C_{13}H_8Br_2O_2$	43.85	43.65	2.27	2.52
VI	Br	H	H	Cl	72	102.8–103.8	$C_{13}H_8BrClO_2$	50.11	50.43	2.59	2.62
VII	Cl	Cl	H	Cl	85	145.5	$C_{13}H_7Cl_3O_2$	51.78	51.66	2.34	2.54
VIII	Cl	Br	H	Br	85	164.6–164.8	$C_{13}H_7Br_2ClO_2$	39.97	39.99	1.81	2.04
		X = SO_2									
IX	Br	H	H	H	74	116.9–117.3	$C_{12}H_9BrO_3S$	46.02	46.02	2.83	2.91
X	CH_3	H	H	Cl	45	79.6– 80.6	$C_{13}H_{11}ClO_3S$	55.22	54.86	3.92	3.49
XI	CH_3	H	Cl	H	68	46.6– 47	$C_{13}H_{11}ClO_3S$	55.22	55.31	3.92	4.00
XII	Br	H	H	CH_3	71	103.1–103.6	$C_{13}H_{11}BrO_3S$	47.72	47.47	3.39	3.71
XIII	Br	H	Cl	H	58	83.2	$C_{12}H_8BrClO_3S$	41.46	41.80	2.32	2.33
XIV	Br	Br	H	Br	63	116.9–117.4	$C_{12}H_7Br_3O_3S$	30.60	30.50	1.49	1.49
XV	Br	Cl	H	Cl	76	126.5–127	$C_{12}H_7BrCl_2O_3S$	37.63	37.53	1.85	1.90

(1) Cross and Snyder, *J. Econ. Entomol.*, **41**, 936 (1948).
(2) Kenaga, *J. Econ. Entomol.*, **42**, 999 (1949).
(3) Kenaga and Hummer, *J. Econ. Entomol.*, **42**, 996 (1949).
(4) Kirby and Read, *J. Sci. Food Agr.*, **5**, 323 (1954).
(5) Cf. Wagner and Zook, *Synthetic Organic Chemistry*, New York, N. Y., J. Wiley and Sons, Inc., 1953, Methods 286 and 552.
(6) All melting points are corrected.

heated together on a water-bath until evolution of hydrogen chloride ceased. After cooling, the solidified mass was triturated with an excess of 1 *N* aqueous sodium hydroxide for 10 minutes. The product was filtered off, washed with water until neutral, dried, and recrystallized from 95% ethanol.

In addition to the new compounds listed in Table I the following compounds previously reported in the literature have been prepared and tested: *p*-cresyl benzoate, m.p. 72°; *p*-cresyl *p*-toluate, m.p. 90.2–91.8°; *p*-chlorophenyl *p*-chlorobenzoate, m.p. 96°; 2,4-dichlorophenyl benzoate, m.p. 94.2–95.2°; phenyl *p*-toluenesulfonate, m.p. 95.8–97.5°; *p*-cresyl *p*-toluenesulfonate, m.p. 67.4–68.1°; *p*-bromophenyl *p*-toluenesulfonate, m.p. 92.3–95°; *p*-bromophenyl *p*-bromobenzenesulfonate, m.p. 121.6°; *p*-chlorophenyl *p*-bromobenzenesulfonate, m.p. 108.8–110°; 2,4-dichlorophenyl *p*-toluenesulfonate, m.p. 120.6–121°; and 2,4-dibromophenyl *p*-toluenesulfonate, m.p. 120.6–122.2°.

Acknowledgment. Thanks are due to Professor E. D. Bergmann for his advice; and to Professor G. G. Mer and Dr. R. Cwilich of the Malaria Research Station of the Hebrew University, Rosh Pina; and to K. R. S. Asher and R. Cordova of the Research Laboratories, Medical Corps, Israel Defence Forces, for biological tests.

P. O. Box 5192
JERUSALEM, ISRAEL