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NEMATICIDAL EFFICACY OF SUBSTITUTED PHENOLS, PHENOXYACETIC ACID ESTERS AND HYDRAZIDES: A STRUCTURE-ACTIVITY RELATIONSHIP STUDY

BY

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The nematicidal activity of various substituted phenols, phenoxyacetic acid esters and hydrazides was determined against second stage juveniles of seed-gall nematode (*Anguina tritici*), root-knot nematode (*Meloidogyne javanica*) and pigeon-pea cyst-nematode (*Heterodera cajani*). The phenols with electron-donating substituents in general and chloro-substituent in particular and the corresponding substituted phenoxyacetic acid esters were found to show good nematicidal activity, while the hydrazides were largely inactive.

Keywords: Phenols, phenoxyacetic acid esters, hydrazides, juvenile mortality, synthetic products, nematicides, nematode control.

The short-chain alkylating agents and cholinesterase inhibiting carbamates and organophosphates are much used in nematode pest control and little effort has been made to evaluate other classes of compounds (Feldmesser & Kochansky, 1983). Data on the relationship between chemical structure and nematicidal activity is also, therefore, scanty. Certain plants and their products have recently been reported to possess good nematicidal activity (Chatterjee *et al.*, 1982; Evans *et al.*, 1984; Gommers, 1981; Malik *et al.*, 1985, 1987a and 1987b; Sangwan *et al.*, 1985) and in many cases, the active nematicidal constituent has been found to be a phenol derivative. In an attempt to develop safe nematicides and to study the effect of chemical structure on nematicidal activity, several substituted phenols, phenoxyacetic acid esters and hydrazides were screened for nematicidal activity and the results are described in this paper.

MATERIALS AND METHODS

The phenols (*1-13*, Scheme 1, Table I) and anisole (*14*) were available commercially and were used as such. The phenols were converted into the corresponding substituted phenoxyacetic acid ethyl esters (*15-21*) by stirring with ethyl bromoacetate and potassium carbonate in dimethylformamide at room temperature according to the general method reported earlier (Malik *et al.*, 1983; Sangwan *et al.*, 1988) in 60-80% yields. The corresponding substituted

TABLE I

Nematicidal activity of substituted phenols, phenoxyacetic acid esters and hydrazides

Compound No.	Ar	LC_{50} μg ml^{-1} against *A. tritici*	*M. javanica*	*H. cajani*
A: *Substituted phenols* (Ar-OH)				
1	C_6H_5	1079	<50	163
2	2-Cl-C_6H_4	612	273	323
3	4-Cl-C_6H_4	<50	85	213
4	2-C_2H_5O-C_6H_4	307	1122	399
5	4-C_2H_5O-C_6H_4	914	156	58
6	3-H_2N-C_6H_4	>4000	>4000	1488
7	3-O_2N-C_6H_4	668	**87**	293
8	4-O_2N-C_6H_4	855	**506**	144
9	4-H_3C-CO-C_6H_4	>4000	1080	1116
10	4-H_5C_2-CO-C_6H_4	>4000	953	1473
11	4-(CH_2=$CHCH_2$),2-CH_3O-C_6H_3	<50	1244	719
12	2,4,5-$(Cl)_3$-C_6H_2	<50	<50	<50
13	4-Cl, 2,5-$(CH_3)_2$-C_6H_2	51	<50	58
B: *Anisole*	C_6H_5-OCH_3 (*14*)	1377	>4000	2173
C: *Substituted phenoxyacetic acid esters* (Ar-O-CH_2-$COOC_2H_5$)				
15	C_6H_5	<50	<50	<50
16	2-Cl-C_6H_4	<50	537	470
17	4-Cl-C_6H_4	253	**274**	356
18	4-O_2N-C_6H_4	1493	**284**	203
19	4-H_3C-CO-C_6H_4	969	**216**	295
20	2,4,5-$(Cl)_3$-C_6H_2	412	**474**	147
21	4-Cl, 2,5-$(CH_3)_2$-C_6H_2	114	**129**	164
D: *Substituted phenoxyacetic acid hydrazides* (Ar-O-CH_2-$CONHNH_2$)				
22	C_6H_5	488	138	<50
23	2-Cl-C_6H_4	137	**904**	263
24	4-Cl-C_6H_4	3252	267	349
25	4-O_2N-C_6H_4	>4000	2023	2291
26	4-H_3C-CO-C_6H_4	2746	1279	775
27	2,4,5-$(Cl)_3$-C_6H_2	>4000	>4000	>4000
28	4-Cl, 2,5-$(CH_3)_2$-C_6H_2	>4000	>4000	1715
D: *Conventional nematicide*				
29	Aldicarb	170	<50	<50

phenoxyacetic acid hydrazides (*22-28*) were prepared by refluxing the esters (*15-21*) with hydrazine hydrate in ethanol (Sangwan *et al.*, 1986) in 50-70% yields. These chemical transformations were examined by concurrent expected

$$\underset{1\text{-}13}{\text{Ar-OH}} \rightarrow \underset{15\text{-}21}{\text{Ar-O-CH}_2\text{-COOC}_2\text{H}_5} \rightarrow \underset{22\text{-}27}{\text{Ar-O-CH}_2\text{CONHNH}_2}$$

SCHEME-1

change in IR spectra of the product recorded on a Perkin-Elmer Infracord 157 spectrophotometer. The compounds were checked for their purity by thin-layer chromatography over silica gel-G and only pure compounds (subjected