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Note

Synthesis and Acaricidal Activity of *N*-(1,3,4-Thiadiazol-2-yl)cyclopropanecarboxamides

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INTRODUCTION

In our previous paper, we reported the structure-activity relationships of acaricidal *N*-(1,3,4-thiadiazol-2-yl)carboxamides.[1] In the course of our study, a series of *N*-(1,3,4-thiadiazol-2-yl)cyclopropanecarboxamides were synthesized and their acaricidal activities were examined.[2] This paper describes the structure-activity relationships of acaricidal *N*-(1,3,4-thiadiazol-2-yl)cyclopropanecarboxamides.

MATERIALS AND METHODS

1. *Synthesis of Compounds*

Melting points were uncorrected. The structures of compounds were confirmed by ^{1}H NMR spectra. ^{1}H NMR spectra were measured on a Varian UNITY 300 spectrometer at 300 MHz using tetramethylsilane as an internal standard. *N*-(1,3,4-Thiadiazol-2-yl)cyclopropanecarboxamides were synthesized from cyclopropanecarboxylic acids and 2-amino-1,3,4-thiadiazoles (Fig. 1). 2-Amino-5-substituted-1,3,4-thiadiazoles were purchased from commercial sources or synthesized according to the reported procedure.[3,4] Cyclopropanecarboxylic acids were purchased from commercial sources or synthesized according to the reported procedure.[5,6]

1.1. *2,2-Dichloro-N-(5-heptafluoropropyl-1,3,4-thiadiazol-2-yl)-1-methylcyclopropanecarboxamide (**10**)*

A mixture of 2,2-dichloro-1-methylcyclopropanecarboxlic acid (0.51 g, 3.0 mmol) and thionyl chloride (2 ml) was refluxed for 1 hr and evaporated to yield crude acid chloride. To this, dichloromethane (5 ml), 2-amino-5-heptafluoropropyl-1,3,4-thiadiazole (0.81 g, 3.0 mmol) and pyridine (0.49 ml, 6.0 mmol) were added and the resulting mixture was stirred for 1 hr at room temperature. Diluted hydrochloric acid was added and the resulting mixture was extracted with ethyl acetate. The organic layer was washed with saturated aqueous sodium chloride and dried over sodium sulfate. The resulting solid was washed with hexane to yield **10** (0.69 g, 55%). mp: 127–129°C; ^{1}H NMR ($CDCl_3$) δ: 1.65 (1H, d, J=7.8 Hz), 1.88 (3H, s), 2.46 (1H, d, J =7.8 Hz).

2. *Biological Tests*

Test species of mites (*Tetranychus urticae*) and the method used were the same as previously reported.[7]

The activity rating was expressed as indices of 0 to 3, corresponding to 0–29, 30–79, 80–99 and 100% mortality, respectively.

RESULTS AND DISCUSSION

Table 1 shows the effect of substituents (R) at 1-positon of cyclopropane ring. The methyl (**2**) and ethyl (**3**) analogs showed activity against *Tetranychus urticae* at 50 ppm. Elongation (**4** and **6**) or branching (**5**) of alkyl group resulted in a loss of activity. The compound without the alkyl group (R=H, **1**) was utterly inactive.

Table 2 shows the effect of chlorine atoms at the 2-position of the cyclopropane ring. The nonchlorinated compound (**7**) did not show any activity at 500 ppm. Replacement of the chlorine atoms with bromine (**8**) resulted in reduced activity.

Table 3 shows the effect of substituent (Y) at the 5-position of the thiadiazole ring. Only the fluoroalky analogs (**2**, **9**–**11**) showed activity at 500 ppm. Among these, the heptafluoropropyl analog (**10**) showed the highest activity. Unsubstituted (**12**) and alkyl analogs (**13** and **14**) were inactive at 500 ppm.

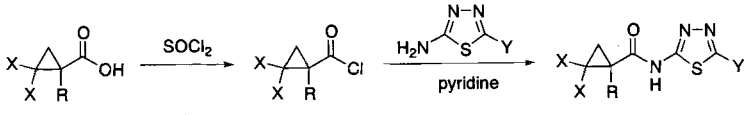

Fig. 1. Synthetic route of *N*-(1,3,4-thiadiazol-2-yl)cyclopropanecarboxamides.

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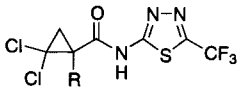
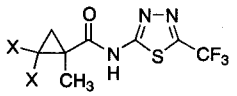
Table 1. Effect of substituent R on activity against *Tetranychus urticae*



No.	R	mp (°C)	Activity rating (*Tetranychus urticae*)			
			500	200	50	12.5 (ppm)
1	H	173-174	0	-[a)]	-	-
2	CH_3	131-132	3	3	3	1
3	C_2H_5	147-148	3	3	3	0
4	n-C_3H_7	115-118	3	3	2	0
5	i-C_3H_7	180-183	2	2	1	1
6	n-C_4H_9	150-151	2	1	-	-

[a)] Not tested.

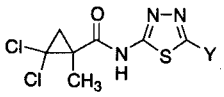
Table 2. Effect of substituent X on activity against *Tetranychus urticae*



No.	X	mp (°C)	Activity rating (*Tetranychus urticae*)			
			500	200	50	12.5 (ppm)
7	H	128-129	0	-[a)]	-	-
2	Cl	131-132	3	3	3	1
8	Br	135-136	3	3	1	0

[a)] Not tested.

Table 3. Effect of substituent Y on activity against *Tetranychus urticae*



No.	Y	mp (°C)	Activity rating (*Tetranychus urticae*)			
			500	200	50	12.5 (ppm)
2	CF_3	131-132	3	3	3	1
9	CF_2CF_3	108-110	3	3	3	1
10	$(CF_2)_2CF_3$	127-129	3	3	3	2
11	$(CF_2)_3CF_3$	80-82	0	-[a)]	-	-
12	H	137-138	0	-	-	-
13	CH_3	166-167	0	-	-	-
14	C_2H_5	162-163	0	-	-	-

[a)] Not tested.

REFERENCES

1) Y. Shiga, I. Okada and T. Fukuchi: *J. Pesticide Sci.* **28,** 58–60 (2003).
2) I. Okada, Y. Shiga and T. Fukuchi (Mitsubishi Chemical Co.): Jpn. Kokai Tokkyo Koho JP 2001–172271 (2001).
3) G. W. Steahly (Monsanto Chemical Co.): U.S. US2497825 (1950).
4) R. A. Kulp (Gulf Oil Co.): U.S. US 4264616 (1981).
5) E. V. Dehmlow: *Angew. Chem. Int. Ed. Eng.* **13**, 170–179 (1974).
6) Y. Kurahashi, S. Kagabu, S. Sakawa, N. Matsumoto and T. Yamada (Nihon Bayer Agrochem Co., Ltd.): Jpn. Kokai Tokkyo Koho JP 62–201855 (1987).
7) I. Okada, S. Okui, Y. Takahashi and T. Fukuchi: *J. Pesticide Sci.* **16**, 623–629 (1991).