JOURNAL OF PLANT PROTECTION RESEARCH
Vol. 40, No. 2 2000

INFLUENCE OF CHEMICAL COMPOUNDS ON GERMINATION AND DEVELOPMENT OF *DIPLOCARPON ROSAE*

ADAM T. WOJDYŁA, JADWIGA ŁYŚ

RESEARCH INSTITUTE OF POMOLOGY AND FLORICULTURE, POMOLOGICZNA 18, 96-100 SKIERNIEWICE, POLAND

Abstract. Efficacy of azoxystrobin, dichlofluanid, imazalil, kresoxim-methyl, propiconazole and triforine (standard) in the control of *Diplocarpon rosae* was evaluated in the years 1997-1999. The compounds were applied as a plant spray. First treatment of plants was performed when first disease symptoms occurred on leaves and spraying was repeated 9 times at weekly intervals. In the autumn of 1999 plants not previously treated with fungicides and showing visible disease symptoms were spraye and after one, 7 and 14 days diseased leaves were sampled. Spores from leaves were transferred onto Petri dishes with potato-dextrose agar. Number of germinating spores was counted after 24 h incubation (4 Petri dishes for each compounds).
After 9-weeks protection of rose shrubs with the tested compounds the spread of mycelium on new leaves was strongly inhibited. Only bupirimate at concentration 0,05% gave very poor control of *D. rosae*. All other tested compounds were better or as good as triforine. Reduction of concentrations used resulted in lower effectiveness. After 1, 7 or 14 days from the last spraying of plants with dichlofluanid, kresoxim-methyl and triforine germination of fungus spores was below 9% except kresoxim-methyl at concentration 0.01% after 14 days (12.5%).

Key words: *Diplocarpon rosae*, fungicides, germination, effectiveness, roses

I. INTRODUCTION

Black spot of roses caused by *Diplocarpon rosae* Wolf., is one of the most common and important diseases of field grown roses. Susceptible cultivars may loose all leaves when not protected in time (Horst 1983). Diseases can be controlled by cultivation of less susceptible cultivars (Wiśniewska and Wojdyła 1995) or by biological methods, for example use of garlic juice (Qvarnström and Rämert 1992). However, because of its high efficacy chemical protection remains the main method of control of the disease. In Poland, trials on rose protection against *D. rosae* have been conducted for many years (Baranowski et al. 1975; Wojdyła 1992; Wojdyła and Orlikowski 1985). For some time the chemicals that inhibited biosynthesis of ergosterol are being an important group of fungicides used against this pathogen (Wojdyła 1992; Wojdyła and Orlikowski 1992). In the recent years, the chemical belonging to strobilurin group were introduced. They exhibit new mechanism of action based on interruption of electron transport in mitochondria between cytochrome b and cytochrome c_1 (Godwin et al. 1992). Until now there is no information available on the effectiveness of fungicides from this group against rose diseases including *D. rosae*. Fungicides from strobilurin group may become especially valuable for control of pathogen isolates

resistant to older chemicals. In the literature there is no information on the effect of fungicides used against *Diplocarpon rosae* on germination of fungus spores.

The aim of the experiment was to evaluate the influence of 7 chemical compounds on development of *Diplocarpon rosae* in field conditions as well as germination of fungus spores.

II. MATERIAL AND METHODS

Effects of azoxystrobin (Amistar 250 EC), bupirimate (Nimrod 250 EC, dichlofluanid (Euparen Multi 50 WP), imazalil (Magnat 50 EC), kresoxim-methyl (Discus 500 WG), propiconazole (Bumper 250 EC), and triforine (Saprol 190 EC) as a standard on development of *Diplocarpon rosae* were evaluated in 1997 and 1998. The experiments were conducted on rose 'Madelon' growing in the field. When first symptoms of disease occurred on leaves, shrubs were sprayed 10 times at weekly intervals. Citowett at the concentration 0.01% was added to spraying mixtures. The effectiveness of tested compounds was evaluated after 3,6 and 9 weeks of experiment according to 6-grade scale: 0 – no disease symptoms, 1 – from 0.1 to 25% of leaves with disease symptoms, 2 – over 25% of leaves with disease symptoms, 3 – up to 25% of fallen leaves and the rest with disease symptoms, 4 – from 25 to 50% of fallen leaves, 5 – from 50 to 90% of fallen leaves, 6 – over 90% of fallen leaves.

In the second experiment plants of the same cultivar with visible disease symptoms were sprayed with the tested compounds in the autumn. One, 7 and 14 days after spraying, leaves with visible disease symptoms were sampled. In the laboratory a droplet of sterilized water was put on the leaf surface and spores were scraped with razor blade onto potato-dextrose agar. A second droplet of water was added to the suspension of spores which was then spread over the medium surface. To reduce development of bacteria rose bengal 0.5 mg/dm^3 and 80,000 units penicillin per dm^3 were added to the medium. After 44-48 h incubation at 18-20° total number of spores and number of germinating spores in the observation field were counted under light microscope at magnification 125x. For counting, places with 30-60 spores at the observation field were selected. In the case of high number of spores they were counted only from a half or 1/4 of observation field. Next, per cent of germinating spores was calculated. The experiment was conducted in 3 series with spraying dates 1999.09.20; 1999.10.11; and 1999.10.18.

III. RESULTS

Three subsequent observations, after 3, 6 and 9 weeks of experiment were done in 1997 (Tab. 1). On control plants disease symptoms systematically increased from the initial level of 0.84 to 2,6 and 5.0 after 3 and 9 weeks, respectively. High infection level was noted also on plants sprayed with bupirimate. Thus earlier information about low efficacy of this compound (Wojdyła and Orlikowski 1985) was confirmed. Other tested compounds showed

Table 1

Efficacy of chemical compounds in the control of *Diplocarpon rosae*

Initial disease index and beginning of experiment: 1997.07.09 = 0.84* and 1998.06.25 = 0.75**

Chemical compounds	Concn. in %	Degree of rose shrubs infection after weeks					
		3*	6*	9*	3**	6**	9**
Control	–	2.60	4.80	5.00	3.10	5.40	5.70
Triforine	0,03	0.15	0.50	0.40	1.05	1.30	2.70
Azoxystrobin	0,00625	0.30	0.60	0.63	1.70	1.45	3.30
Azoxystrobin	0,0125	0.15	0.50	0.45	1.35	1.40	3.05
Azoxystrobin	0,025	0.20	0.50	0.40	0.80	1.45	2.45
Bupirimate	0,05	2.55	2.90	2.80	2,45	2.80	5.40
Dichlofluanid	0,075	–	–	–	0.75	1.40	2.10
Dichlofluanid	0,125	–	–	–	0.30	1.00	0.50
Imazalil	0,025	0.30	0.20	0.65	0.30	1.05	2.30
Imazalil	0,05	0.15	0.15	0.35	0.35	1.15	1.65
Kresoxim-methyl	0,005	0.20	0.35	0.70	0.85	1.20	1.45
Kresoxim-methyl	0,01	0.15	0.05	0.15	0.45	0.75	0.65
Propiconazole	0,00625	0.25	0.60	0.40	0.25	0.45	1.10
Propiconazole	0,0125	0.10	0.15	0.10	0.25	0.20	0.30
NIR (0.05%)		0.165			0.276		

similar or higher effectiveness than triforine (standard). Only after 9 weeks of the experiment imazalil and kresoxim-methyl in reduced concentrations were less effective than triforine. All tested compounds showed higher efficacy when used in higher concentrations.

In 1998 the increase in disease symptoms was observed on control plants (Tab. 1) during the experiment. After 3 weeks of spraying only azoxystrobin at the concentration

Table 2

Influence of chemical compounds on spores germination (in %) of *D. rosae*

Chemical compounds	Con. in %	Days after spraying		
		1	7	14
Control	–	85.7	87.9	92.3
Triforine	0.03	4.0	6.6	5.3
Azoxystrobin	0.00625	56.9	56.0	65.7
Azoxystrobin	0.0125	66.8	36.6	40.8
Azoxystrobin	0.025	64.6	20.9	18.7
Bupirimate	0.05	81.5	77.3	72.7
Dichlofluanid	0.075	0.3	0.1	1.3
Dichlofluanid	0.125	0.0	3.6	1.3
Imazalil	0.025	50.6	40.9	43.1
Imazalil	0.05	51.6	31.4	38.4
Kresoxim-methyl	0.005	0.5	8.6	8.6
Kresoxim-methyl	0.01	6.8	7.8	12.5
Propiconazole	0.00625	26.9	15.5	17.4 d
Propiconazole	0.0125	16.7	11.8	17.4
NIR (0.05%)		11.22		

0.00625% was less effective than triforine. After 6 and 9 weeks bupirimate was the least effective compounds with infection level at the end of the trial similar to that unprotected plants. After 9 weeks also azoxystrobin in all tested concentrations was less effective than triforine. Reduced concentrations of fungicides showed lower efficacy.

In rose production intensity of disease symptoms depends among others on cultivars, climatic conditions and level of inoculum. Thus it is important to check the effect of fungicides on germination of fungus spores.

In the next day after treatment no germinating spores were found on leaves collected from shrubs sprayed with dichlofluanid in the concentration 0.125% (Tab. 2). Spores from shrubs treated with triforine 0.03%, dichlofluanid 0.075% and kresoxim-methyl 0.005 and 0.01% germinated in 0.3-6.8%. In contrary, spores coming from plants sprayed with azoxystrobin germinated in 65.9-66.8%. Also after 7 and 14 days spores from the leaves collected from plants treated with dichlofluanid, kresoxim-methyl (after 14 days only at the concentration 0.005%) and triforine germinated in less than 10%. Bupirimate exhibited low effectiveness against *Diplocarpon rosae*, both according to field observations of disease symptoms and germination on fungus spores. Surprisingly, azoxystrobin and imazalil strongly reduced disease symptoms on leaves but only slightly inhibited spore germination.

IV. CONCLUSIONS

1. Azoxystrobin, dichlofluanid, imazalil, kresoxim-methyl, propiconazole and triforine were highly effective against *Diplocarpon rosae*.
2. Reduction of concentration resulted in decreased efficacy of tested fungicides.
3. Dichlofluanid, kresoxim-methyl and triforine inhibited spore germination of *Diplocarpon rosae* by 86-100% comparing to untreated control.

IV. LITERATURE

1. Baranowski T., Paszkiet B., Pekasiewicz H. 1975. Zwalczanie czarnej plamistości róż (*Diplocarpon rosae*) (Lib.) Wolf.) za pomocą kilku fungicydów. Materiały z konferencji poświęconej ochronie roślin ozdobnych. Skierniewice: 49-55.
2. Godwin J,R., Anthony V.M., Clough J.M., Godfrey C.R.A. 1992. ICIA5504: a novel, broad spectrum, systemic b-methoxyacrylate fungicide. Brighton Crop Protection Conference – Pest and Diseases: 435-442.
3. Horst R.K. 1983. Compendium of rose diseases. APS: 7-11.
4. Qvarnström K., Rämert B. 1992: [Control of black spot (*Marssonina rosae*) on garden roses.] Behandlung mot svartfläcksjuka (*Marssonina rosae*) pa frilandsrosor. Växtskyddsnotiser 56, (4): 83-85. Z Rev. Pl. Path. 1994, Vol. 73, abstract 5964.
5. Wiśniewska-Grzeszkiewicz H., Wojdyła A. 1995. Evaluation of rose cultivars to diseases susceptibility. Second International-Symposium on Roses, Antibes, France, 20-24 February 1995, Acta Horticulturae 424: 233--236.
6. Wojdyła A. 1992. Nowe fungicydy do zwalczania *Diplocarpon rosae* Wolf. na różach. Pr. Inst. Sad. i Kwiac., Ser. B, 17: 141-147.

7. Wojdyła A., Orlikowski L.B., 1985. Chemical control of black spot of rose. Pr. Inst. Sad. i Kwiac., Ser. B, 10: 149-156.
8. Wojdyła A., Orlikowski L.B. 1992. New fungicides an ergosterol biosynthesis inhibitors in the control of rose black spot. Pr. Inst. Sad. i Kwiac., Ser. B, 17: 169-177.

A. T. Wojdyła, Jadwiga Łyś

WPŁYW NIEKTÓRYCH ZWIĄZKÓW CHEMICZNYCH NA KIEŁKOWANIE ZARODNIKÓW I ROZWÓJ *DIPLOCARPON ROSAE*

STRESZCZENIE

W latach 1997-1998 oceniano wpływ azoksystrobiny, bupirimatu, dichlofluanidu, imazalilu, krezoksymu-metylowego, propikonazolu oraz triforyny (standard) na rozwój *D. rosae*. Doświadczenia prowadzono na różach odmiany Madelon, uprawianych w polu. Krzewy opryskiwano 9-krotnie, w odstępach 7-dniowych. Po 3, 6 oraz 9 zabiegach przeprowadzono ocenę skuteczności badanych związków. Jesienią 1999 roku krzewy róż z objawami choroby opryskano, a po 1, 7 oraz 14 dniach od wykonania zabiegu pobierano zarodniki i na pożywce ziemniaczano-glukozowej oceniano ich kiełkowanie.

Za wyjątkiem bupirimatu w stężeniu 0,05% wszystkie z badanych fungicydów wykazywały doskonałą skuteczność w zwalczaniu wymienionego patogena. Dichlofluanid 0,125%, imazalil, krezoksym-metylowy 0,01%, propikonazol 0,0125% zdecydowanie przewyższały swoją skutecznością pozostałe badane związki. Stwierdzono istotny wpływ stężenia stosowanych fungicydów na ich skuteczność. Obniżenie stężenia badanych związków wiązało się ze spadkiem ich skuteczności.

Dichlofluanid w stężeniu 0,075% i 0,125% oraz krezoksym-metylowy 0,005% i 0,01% hamowały kiełkowanie zarodników *D. rosae* o około 90-100%. Stwierdzono również, że w miarę upływu czasu od wykonania opryskiwania spadała skuteczność badanych związków w ograniczaniu kiełkowania zarodników *D. rosae*.