Control of Ergot (*Claviceps purpurea* (Fr.) Tul.) Ascoscarpus Formation under the Impact of Chemical and Biological Seed Dressing

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Abstract

The present paper discuses the feasibility of ergot contaminants control in rye seeds through seed dressing. The objective of the work was to determinate the impact of chemical and biological seed dressing on sclerotia germination and ascocarps formation. Germination (%) of sclerotia treated with most of the investigated fungicidal action chemical seed dressers was significantly lower than that of untreated sclerotia. Although some chemical seed dressers did not give very good control of sclerotia germination, they delayed ascocarps emergence and significantly reduced their number above the soil surface at rye anthesis. Biocontrol agents did not have any significant effect on sclerotia germination and ascocarps formation.

Keywords: *Claviceps purpurea;* ergot; sclerotia; ascocarps; winter rye; chemical and biological seed dressers

INTRODUCTION

Ergot, *Claviceps purpurea* (Fr.) Tul., occurs to some extent on *Poacea* family plants in Lithuania every year. 79 wild and cultivated plant species and forms were identified to be affected by ergot. The disease was found in 5 cereal species (DABKEVIČIUS 1997). Ergot is generally more prevalent in rye and triticale than in the other cereals. During 1996–2000 65.9% of winter rye stands and 40.3% of winter triticale stands of the total area under observation were affected by ergot. On average 4.0 and 4.7% of ears were with sclerotia in the affected area (DABKEVIČIUS & SEMAŠKIENĖ 2001). In nature the sclerotia of *C. purpurea* mature at about the same time as the healthy grain. At harvest, some sclerotia fall to the ground but many are collected with the seed (LOVELESS & PEACH 1986). Small sclerotia and their pieces similar in size and shape to cereal seeds may pass through cleaning machinery, and eventually be sown alongside with seed. One way to decrease the risk of infection is seed dressing. Some authors have investigated the influence of some seed dressers on sclerotia germination (SHAW 1984, 1986). But many new seed dressers are not currently approved for application as treatment to control ergot. This study was conducted to investigated the feasibility of ergot contaminants control in rye seeds by seed dressing. The objective of the work reported in this paper is to determinate the impact of chemical and biological seed dressing on sclerotia germination and ascocarps formation.

MATERIALS AND METHODS

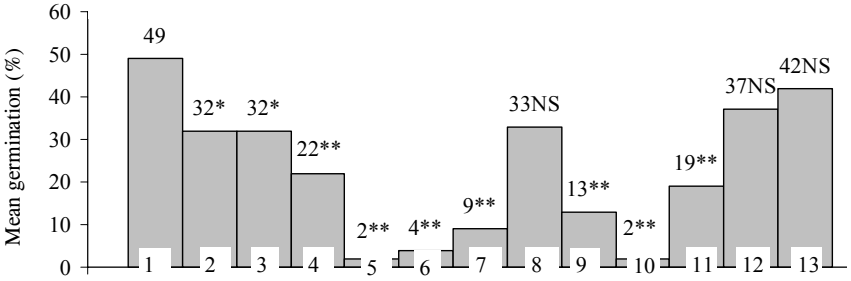
Sclerotia of *C. purpurea* were collected from winter rye fields in Dotnuva, Kėdainiai District. 300 sclerotia were mixed with rye seeds up to 1 kg to provide sufficient bulk for application of seed dressers in a Hege 11 at manufactures' recommended rates. Ten chemical seed dressers with different mode of action and composition as well as two biocontrol agents based on micro-organisms' antagonistic action were used in the experiment. The following chemical seed dressers were tested: triadimenol 15 g/kg + fuberidazol 2.0 g/kg + imazalil 2.5 g/kg (trade name Baytan Universal 19.5 WS, rate 2.0 g/kg seeds), flutriafol 25 g/l +

tiabendazol 25 g/l (Vincit 5 SC, 2 ml/kg), carboxine 200 g/l + thiram 200 g/l (Vitavax 200 FF, 3.0 ml/kg), guazotine 350 g/l (Panoctine 35 LS, 2.0 ml/kg), fludioxonil 25 g/l (Maxim 025 FS, 2.0 ml/kg), fludioxonil 25 g/l + epoxiconazole 10 g/l (Maxim Star 035 FS, 1.5 ml/kg), tebuconazole 20 g/kg (Raxil 2WS, 1.5 g per kg), ethirimol 40 g/l + flutriafol 1 g/l + thiabendazole 3 g/l (Ferrax, 3 ml/kg), benomyl 500 g/kg (Fundazol 50WP 2.5 g/kg), carboxine 750 g/kg + imazalil 25 g/kg (Kemikar 775 WP, 2 g/kg). Fungus *Trichoderma lignorum* strain *istokskij* (titre 10^9spor/g) and bacteria *Pseudomonas aureofaciens* (trade name Kaelsi-Micros, rate 0.2 ml/kg seeds) were used as biocontrol agents. The counted sclerotia were subsequently separated from the rye grain/sclerotia mixture. Treated and untreated ergot sclerotia were placed on 1 m long rows in late October in the unsown patch on rye fields. The rows were arranged in a completely randomized design with five replicates. 20 sclerotia per row under field were inserted in the soil at depth of 2 cm. The assessments of germinated sclerotia and ascocarp production were begun at the beginning of winter rye heading and were finished at end of anthesis. The number of ascocarps visible above the soil surface were determined during each assessment (every 4 days). The experiments were continued for two years.

For the statistical analysis, the data were arc sine transformed to stabilise the variance. The significance of data was determined by F test with a significance level of $P \leq 0.01$ and $P \leq 0.05$.

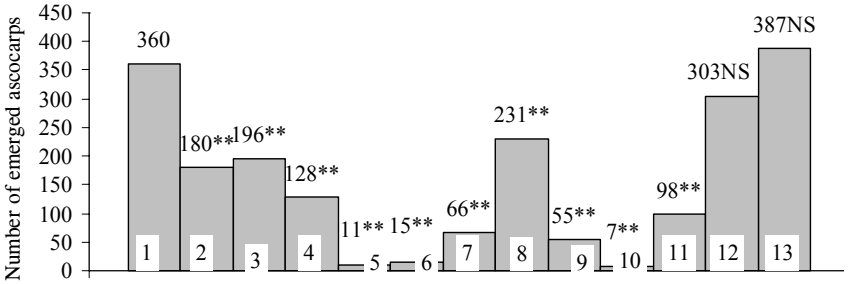
RESULTS AND DISCUSSION

In field experiments sclerotia germination was defined as the presence of at least one ascocarp, visible on the soil surface. In both experimental years the first ascocarps were identified on the soil surface at rye heading. Untreated and treaded with biocontrol agents sclerotia start to germinate at the same time and at the same intensity. 23.0% of untreated and treated with bacteria *Pseudomonas aureofaciens* sclerotia germinated at winter rye GS 55-59. After application with fungus *Trichoderma lignorum* 19.5% of sclerotia germinated. In both years sclerotia germination and ascocarpus formation in untreated and treated rows was the most intensive at winter rye GS 61-65. After GS 69 ascocarps start decline. In this paper we have presented results of the efficacy of seed dressers with different mode action at GS 69, when the maximum of germinated sclerotia was determined. Germination of untreated sclerotia was on average 49% (Figure 1). Most decreases in sclerotia germination after chemi-



Significantly different from untreated *$P \leq 0.05$, **$P \leq 0.01$. NS – not significant at $P \leq 0.05$

Figure 1. Effect of seed treatments on sclerotia germination (%)



Significantly different from untreated **$P \leq 0.01$. NS – not significant $P \leq 0.05$

Figure 2. Effect of seed treatments on the number of ascocarps emerging above the soil surface

Explanation for Figures 1 and 2:

1 – Untreated
2 – Fuberidozole/imazalil/triademinol
3 – Flutriafol/tiabendazole
4 – Carboxin/thiram
5 – Guazatine
6 – Fludioxonil
7 – Fludioxonil/epoxiconazole
8 – Tebeconazole
9 – Ethirimol/flutriafol/thiabendazole
10 – Benomyl
11 – Carboxin/imazalil
12 – *T. lignorum*
13 – *P. aureofacienns*

cal seed dressing were satisfactory and significant. Guazatine, benomyl and fludioxonil reduced fungal growth very well. Only 2–4% of sclerotia germinated after application of these compounds. A similar efficacy of guazatine and fludioxonil on sclerotia germination was obtained in Belarus (BUGA & NEMKOVICH 1997). Fludioxonil/epoxiconazole, ethirimol/flutraifol/thiabendazole, carboxin/imazalil and carboxin/thiram gave a good decrease of sclerotia germination with high level of significance ($P \leq 0.01$). Fuberidazole/imazalil/triadimenol and flutriafol/tiabendazole showed the lowest significant effect on sclerotia germination. Efficacy of biocontrol agents and tebuconazole was low and not significant.

Untreated germinated sclerotia formed 360 ascocarps (Figure 2). All chemical seed dressers with fungicidal action significantly decreased ascocarps emergence. Only *P. aureofaciens* and *T. lignorum* did not have any effect on ascocarps formation. Most of the tested chemical seed dressers reduced emerged the number of ascocarps per 1 germinated sclerotia. After application of fludioxonil and benomyl the number of ascocarps per 1 germinated sclerotia decreased 49.3 and 52.0%, respectively. Fludioxonil/epoxiconazole, tebuconazole and biocontrol agents did not have any effect on the number of ascocarps on germinated sclerotia. Other chemical dressers reduced ascocarps emergence on sclerotia 16.4–42.5%.

Generally, germination (%) of sclerotia treated with most of the tested fungicidal action chemical seed dressers was significantly lower than that of untreated sclerotia. Although some chemical seed dressers did not give very good control of sclerotia germination, they delayed ascocarps emergence and significantly reduced their number above the soil surface at rye anthesis. Biocontrol agents did not have any significant effect on sclerotia germination and ascocarps formation.

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