Response of micromycetes to the effect of mint volatile oil

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Response of 28 micromycete species to the effect of mint volatile oil of different concentration was investigated. The effect of volatile fractions of mint volatile oil on the growth of micromycetes was ascertained. The response of micromycetes to the effect of mint volatile oil was found to depend on the species of micromycetes, concentration of volatile oil and composition of nutrient medium. The micromycetes *Trichoderma viride* and *Cladosporium resinae* were most resistant to mint volatile oils. The growth of micromycetes was inhibited by 100% with the help of mint volatile oil (250–500 mg/l).

Key words: fungi, micromycetes, mint, volatile oils

INTRODUCTION

Micromycetes and their metabolites not only destroy natural and synthetic substances (paper, wood, rubber, plastics, oil and oil products, glass, metal, concrete, etc.), but may also cause human diseases. It is important to stop micromycete spreading in the environment [1, 2]. To this end, fungicides able to destroy micromycete cells, disturb their metabolic processes and thus inhibit the growth of micromycetes are searched for.

Since ancient times *mint* has been known as an officinal, antiseptic plant. More than 3600 years ago the Egyptians described the mints which used to grow in their gardens. Mint volatile oil is extremely valuable. The Japanese were the first to evolve menthol from mint volatile oil. Mints have been cultivated in Europe since the seventeenth century. The peppermint (*Mentha piperita L.*) is one of the mints that accumulate plenty of volatile oils. Selectionists have bred different sorts of peppermint. Menthol is the most valuable component of peppermint volatile oil. 40–78% of menthol are present in the leaves of peppermint. Approximately 9500 tons of volatile oil are produced from peppermint every year in the world. 4500 tons of menthol are isolated from the above-mentioned amount of volatile oil [3]. Scientists of different countries investigate the antimicrobic properties of volatile oils of plants. Most often investigation of bacteria is carried out. As regards the micromycetes, the fungus group *Aspergillus niger* is investigated. The aim of our research was to investigate the reaction of different micromycete species widespread in our environment to the effect of mint volatile oil and to ascertain the fungicidal properties of mint volatile oil.

METHODS

The investigation of fungicidal properties of volatile fractions of mint volatile oil (hereinafter MVO) has been carried out by the method of double Petri dishes [4]. Two Petri dishes of equal size were used. Some drops of MVO were poured into the lower dish. Micromycetes were sown on agarosed medium in the upper dish. The micromycetes were grown on the agarosed Czapek medium with glucose and without it, as well as on agarosed medium without mineral salts and glucose. The edges of the Petri dishes were hermetically sealed. The cultures were grown in a thermostat at a temperature of 26 ± 2 °C within 3–21 days. The diameter of colonies was measured. As regards the other case, the micromycetes were grown on Czapek medium together with volatile oil (100–500 mg/l), and the response of micromycetes was investigated. The inhibiting effect of MVO (R,%) on the growth of micromycetes was calculated according to the formula:

$$R = (D0 - D1) \times 100/D0,$$

where D0 is the diameter (mm) of the control colony control, D1 is the diameter of the study colony [2].

RESULTS

The response of micromycetes to the effect of mint volatile oil was different and depended upon the functional peculiarities of micromycete species, MVO concentration and the composition of nutrient medium. Investigation of the effect of MVO volatile fractions (8; 16.5; 22.5; 33 mg in Petri dish) on the growth of micromycetes showed that the more saturated with nutrient materials medium was, the less inhibited growth of micromycetes was observed. On the seventh

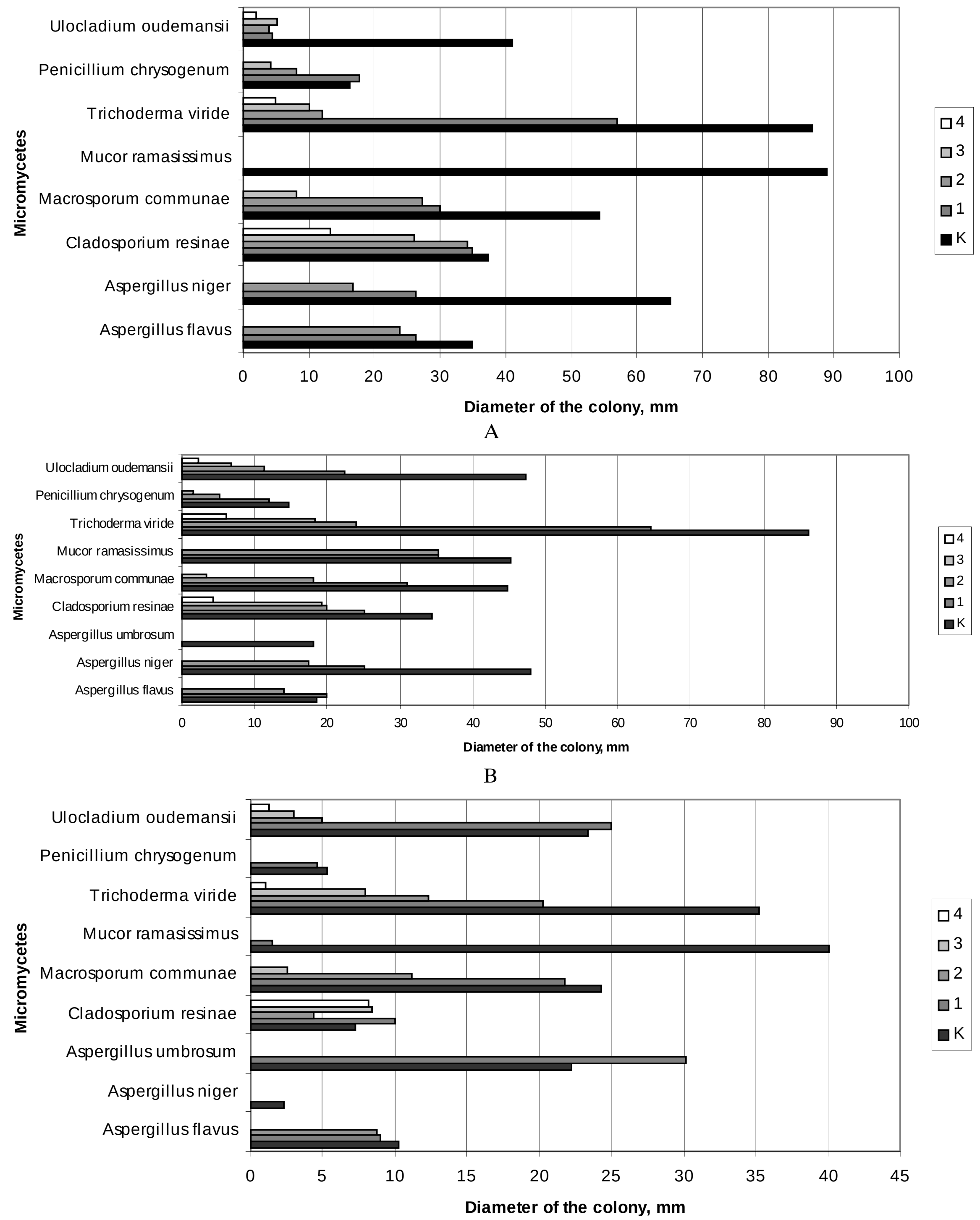

Fig. 1. The effect of volatile fractions of mint volatile oil on the growth of micromycetes on agarosed nutrient medium of different composition (the seventh day of growth):
A – Czapek's medium with glucose, B – Czapek's medium without glucose, C – agarosed medium without mineral salts and glucose. K – control (without volatile oil); concentrations of mint volatile oil in Petri dish, mg: 1 – 8.0; 2 – 16.5; 3 – 22.5; 4 – 33.0

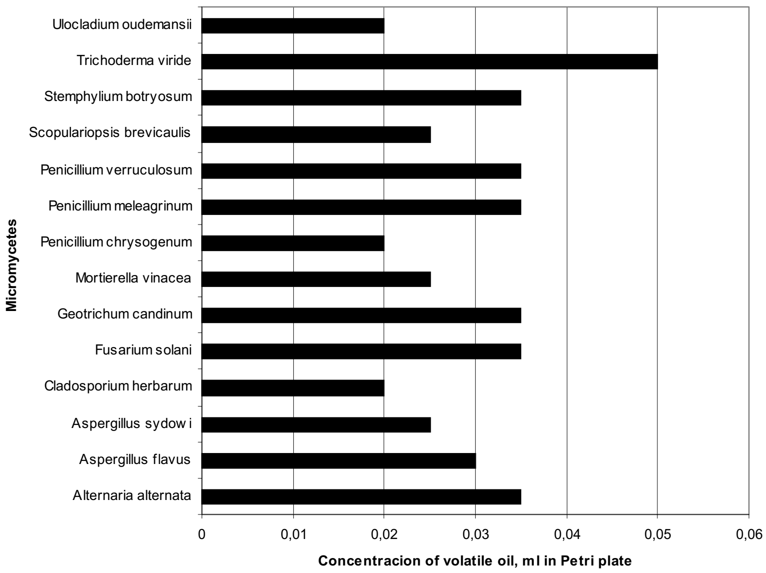

Fig. 2. Dependence of fungicidal properties of volatile fractions of mint volatile oil upon concentration and the species of micromycetes (the amount of MET, ml., in Petri dish, when the growth of micromycetes is inhibited by 100%)

day it was discovered that, due to the presence of 33 mg of MVO in Petri dish, most micromycetes didn't grow (R = 100%). Only the growth of *Cladosporium resinae, Trichoderma viride* and *Ulocladium oudemansii* was stated (Fig. 1). With the presence of 0.01 ml of MVO in a Petri dish, seven species of micromycetes (of nine species investigated) were inhibited slightly, and in certain cases the growth of micromycetes was even stimulated. 250–500 mg/l MVO concentrations inhibited the growth of micromycetes by 100% (Fig. 2). As regards the micromycetes that grew on Czapek's medium containing 100–400 mg/l MVO, it was revealed that with the increase of MVO concentration in the medium the inhibiting effect of MVO also increased (Fig. 3). With the

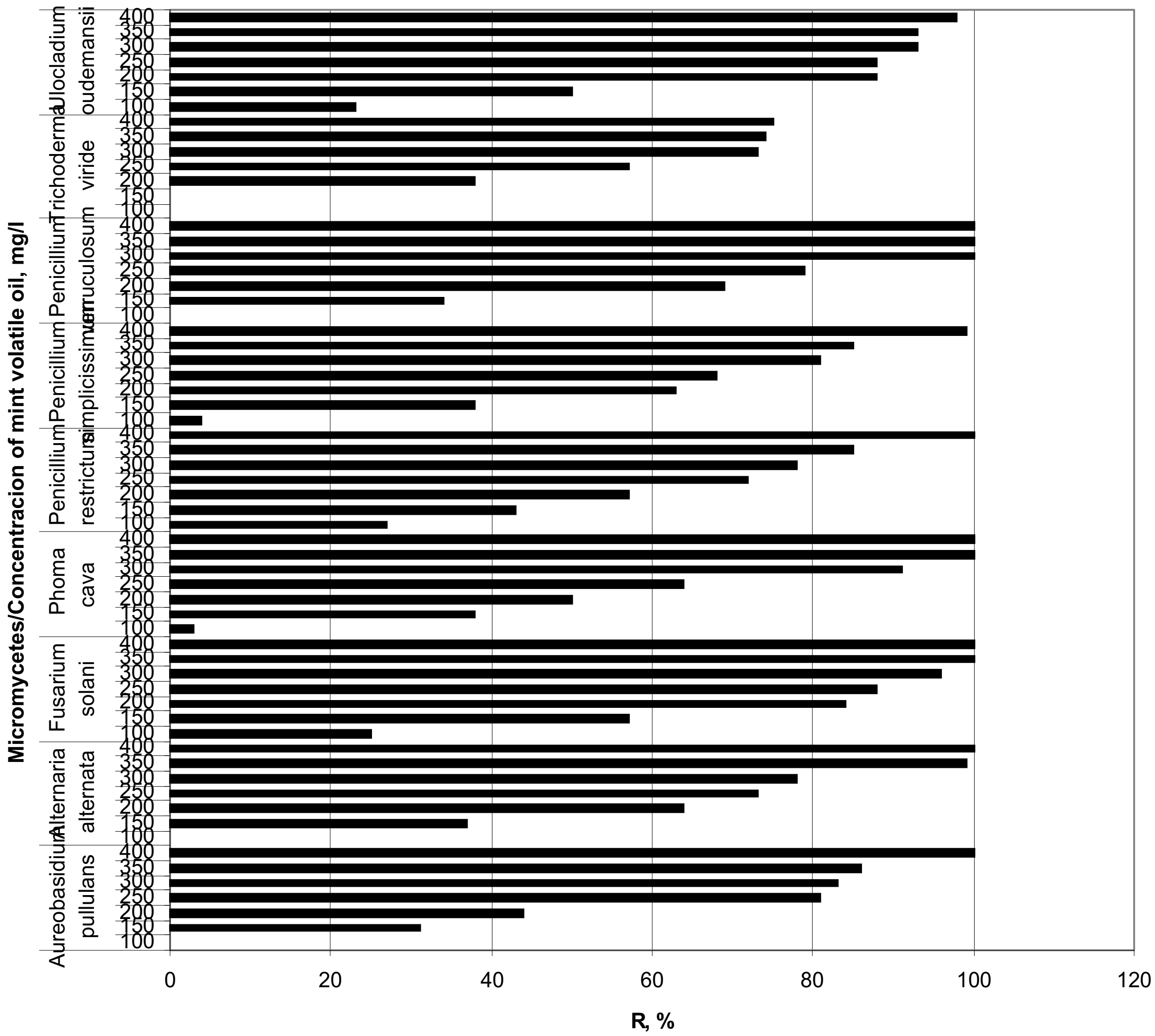

Fig. 3. The inhibiting effect of mint volatile oil (R,%) on the growth of micromycetes. Czapek's medium with MET addition (the seventh day of growth)

presence of 400 mg/l MVO in the medium, only *Trichoderma viride* remained vital. With MVO fungicidal properties having become stronger, the process of micromycete sporification was inhibited. The colour and morphology of the colonies changed. The excretion of exudate became disturbed. Thus, mint volatile oil (250–500 mg/l) exhibits fungicidal properties and can be applied for inhibiting the growth of undesirable micromycetes.

CONCLUSIONS

1. The inhibiting effect of mint volatile oil depended on the micromycete species and the composition of nutrient medium.

2. The response of 28 micromycete species to the effect of mint volatile oil was different. The micromycete species *Trichoderma viride* and *Cladosporium resinae* were most resistant, while *Penicillium chrysogenum* and *Fusarium solani* were most sensitive to the effect of volatile oil.

3. The strongest fungicidal effect of mint volatile oil was fixed with the micromycetes that grew on the agarosed nutrient medium without mineral salts and without saccharose.

4. The fungicidal properties of mint volatile oil were fixed at concentration of 250–500 mg/l.

References

1. Mikrobiologiniai medžiagų pažeidimai (monografija). Sudarė A. Lugauskas. Vilnius, 1997: 10–390.
2. Биоповреждения. Москва, 1987: 41–84.
3. Jaskonis J. Aromatiniai augalai.Vilnius, 1989; 74–80.
4. Методы экспериментальной микологии. Под ред. В. И. Билай. Киев, 1973: 5–142.

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MIKROMICETŲ REAKCIJA Į MĖTŲ ETERINĮ ALIEJŲ

S a n t r a u k a

Tirta 28 mikromicetų rūšių reakcija į įvairios koncentracijos mėtų eterinį aliejų. Ji buvo skirtinga ir priklausė nuo mikromiceto rūšies, eterinio aliejaus koncentracijos bei mitybinės terpės sudėties. Atspariausios mėtų eteriniam aliejui buvo *Trichoderma viride* ir *Cladosporium resinae,* jautriausios – *Penicillium chrysogenum* ir *Fusarium solani* mikromicetų rūšys. Išaiškintas mėtų eterinio aliejaus lakių frakcijų poveikis mikromicetų augimui. Minėtas aliejus mikromicetų augimą slopino 100% esant 250–500 mg/l jo koncentracijai. Taigi mėtų eterinis aliejus gali būti taikomas nepageidaujamam mikromicetų augimui slopinti.