

Effect of Aqueous Extracts of Aspen, Black Currant, Folded Blackberry and Walnut Leaves on Development of Pathogenic Fungi

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Abstract

The antifungal activity of water extracts of dried leaves of folded blackberry (*Rubus plicatus* W. et N.), walnut (*Juglans regia* L.), black currant (*Ribes nigrum* L.), and aspen (*Populus tremula* L.) was assessed in the *in vitro* experiment. The tested fungi were *Alternaria alternata*, *Botrytis cinerea*, *Rhizoctonia solani*, *Fusarium culmorum*, *F. oxysporum* and *F. solani*. It was found that all tested extracts inhibited the development of *A. alternata* and *F. oxysporum*, whereas the strongest inhibiting effect was exhibited by extracts of aspen (*A. alternata* and *F. oxysporum*), black current (*A. alternata*) and folded blackberry (*F. oxysporum*). The tested extracts had no effect on *B. cinerea*.

Keywords: damping – off fungi; growth; inhibition; plant extracts

INTRODUCTION

While eliminating fungicides and substituting them with plant preparations, we may avoid their side effects and control the progressive degradation of agro-systems.

Therefore the interest in these problems is growing and the results of the research on extracts of various plants in many research centres indicate their fungicidal effectiveness, which may be utilised in plant protection (PIOTROWSKI & SAS-PIOTROWSKA 1995; MACHOWICZ-STEFANIAK *et al.* 1995; ORLIKOWSKI & WOLSKI 1998; BURGIEL & SCHWARTZ 1999; STOMPOR-CHRZAN 1999). The new direction in research still requires continuous and comprehensive experimental work for selecting of new plant species, their tested parts and forms in which they are tested.

Thus, the objective of this research was to determine the effect of aqueous extracts of leaves of selected trees and bushes on the development of phytopathogens.

MATERIAL AND METHODS

In the *in vitro* experiment the research material consisted of:

– air dry material (powdered leaves) of folded blackberry (*Rubus plicatus* W. et N.), walnut (*Juglans*

regia L.), black currant (*Ribes nigrum* L.) and aspen (*Populus tremula* L.). The selection of plant material was made on the basis of publications that prove the fungicidal properties of the above-mentioned plants (OŻAROWSKI 1980);

– selected species of fungi isolated from legume plants: *Alternaria alternata* (Fr.) Keissl., *Botrytis cinerea* Pers., *Fusarium oxysporum* Schlecht., *Fusarium culmorum* (W.G.S.) Sacc., *Fusarium solani* (Mart.) Sacc., *Rhizoctonia solani* Kühn.

Tests were performed with 2.5% water extracts in macerated form, which were added to cooled down PDA medium (potato – dextrose – agar) and, after solidification, 5-mm discs of seven-day old fungi cultures were laid on the medium. Control consisted of Petri dishes with pure PDA. Each combination was laid on Petri dishes (ø 90 mm) in 4 replications and series were repeated twice. All cultures were incubated in the dark at 24°C. The mycelium diameters were measured after 4 and 8 days of incubation while taking 2 linear measurements perpendicularly to each other. The inhibition of growth of mycelium of tested species by tested extracts was determined in percentage in relation to mycelium growths in the reference control, using the Abbot formula (KOWALIK & KRECHNIAK 1961).

RESULTS AND DISCUSSION

After 4 days of experiment duration all tested extracts were noted to have inhibiting effect on *Alternaria alternata* (30.3 to 60.2%) and *Fusarium oxysporum* (43.6 to 61.9%) (Table 1). Extracts of aspen, walnut and black currant had also similar effect on *Rhizoctonia solani* (from 26.9 to 59.4% in this order). The inhibiting of colony growth was low or slight for *Botrytis cinerea* (16.1%), *Fusarium culmorum* (9.5%) and *F. solani* (0.7%) in combination with black currant extract, as well as for *B. cinerea* (11.1%) and *F. solani* (16.4%) in combination with walnut extract (Table 1).

The obtained results show no inhibition of 4-day old cultures of *B. cinerea* on medium with folded blackberry and aspen extracts, as well as those of *R. solani* – on medium with folded blackberry extract. Moreover, it was found the walnut leaves extract had a stimulating effect on the growth of *F. culmorum*.

After 8 days of culture only *A. alternata* and *F. oxysporum* of all tested fungi reacted to the presence of all tested extracts in their medium. The growth of *A. alternata* was limited to the range of 11.2% to 56.1%, whereas the strongest inhibiting effect was exhibited by extracts of black currant and aspen (Table 1). Many authors reported the sensitivity of *A. alternata* to vegetable preparations. They showed in *in vitro* experiments that the growth of mycelium of this species was inhibited by aqueous extracts of *Polygonum bistorta* L. rhizome (SAS-PIOTROWSKA *et al.* 1996), herbal mixes: *Quercus petraea* Liebl., *Calendula officinalis* L., *Urtica dioica* L., *Polygonum aviculare* L., *Chamomilla recutita* L., *Salvia officinalis* L. (STOMPOR-CHRZAN 1999). Besides, the plant material added in form of powder (*Zingiber officinale* Rosc.,

Chelidonium majus L., *Cinnamomum zeylanicum* Blume) or pulp (*Allium sativum* L.) to PDA medium inhibited the growth of *A. alternata* (TYLKOWSKA & DORNA 2001).

The growth of *F. oxysporum* was inhibited in the range from 29.1 to 45.6%, with aspen and folded blackberry extracts being most active (in 45.6% and 44.5%, respectively). The sensitivity of those fungi species has been recorded by earlier studies (STOMPOR-CHRZAN 2000). The results of those studies have shown a strong effect of extracts prepared of *Satureja hortensis* L. (*A. alternata* – 85.6% and *F. oxysporum* – 61.1%) and *Coriandrum sativum* L. (*A. alternaria* – 86.9%, *F. oxysporum* – 58.3%).

No reaction to extracts added to the medium was recorded for the remaining tested fungi species (Table 1). No inhibitory effect on the growth of *B. cinerea*, *R. solani*, *F. culmorum* and *F. solani* was recorded for extracts of walnut and aspen as well as black currant. The exception was *R. solani*. The black currant extract inhibited its growth by 59.4%. Besides, the folded blackberry extract in the medium did not inhibit the growth of colonies of *B. cinerea* and *R. solani*.

Conclusions

All tested extracts had inhibiting effect on the growth of mycelium of *Alternaria alternata* and *Fusarium oxysporum*.

The strongest antifungal characteristics was shown by the extracts of aspen and black currant in respect to *A. alternata* and the extracts of aspen and folded blackberry in respect to *F. oxysporum*.

The testes extracts had no inhibiting effect on *Botrytis cinerea*.

Table 1. Inhibiting of colony growth of tested fungi by plant extracts (%)

Plant extracts	Days of incubation	<i>Alternaria alternata</i>	<i>Botrytis cinerea</i>	<i>Rhizoctonia solani</i>	<i>Fusarium culmorum</i>	<i>Fusarium oxysporum</i>	<i>Fusarium solani</i>
Folded blackberry	4	54.2	0.0	0.0	22.5	53.5	28.5
<i>Rubus plicatus</i> W. et N.	8	32.2	0.0	0.0	13.1	44.5	22.2
Walnut	4	30.3	11.1	35.9	40.0	48.3	16.4
<i>Juglans regia</i> L.	8	11.2	0.0	0.0	0.0	34.2	0.0
Black currant	4	60.2	16.1	59.4	9.5	43.6	0.7
<i>Ribes nigrum</i> L.	8	56.1	0.0	19.4	0.0	29.1	0.0
Aspen	4	35.8	0.0	26.9	22.9	61.9	32.4
<i>Populus tremula</i> L.	8	44.9	0.0	0.0	0.0	45.6	0.0

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