Growth of Mycelia of Phytopathogenic Fungi after Application of Abscisic Acid in *in vitro* Conditions

ANTON JANITOR

Institute of Experimental Phytopathology and Entomology, Slovak Academy of Sciences, Ivanka pri Dunaji, Slovak Republic

Abstract

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The effect of abscisic acid (ABA) on growth of mycelia of the phytopathogenic fungi S*chizophyllum commune, Monilia laxa* and *Monilia fructigena* in *in vitro* conditions was studied. All concentrations of ABA (from 10^{-5} to 10^{-9}M) stimulated mycelial growth of these fungi in Lilly-Barnet medium, when cultured for either 10 or 15 days. The results suggest that ABA secretion may be a factor of pathogenicity.

Keywords: *Schizophyllum commune*; *Monilia laxa*; *Monilia fructigena*; mycelium growth; *in vitro* condition; abscisic acid

At present, research on the role of plant growth inhibitors in the host-pathogen relationship is sometimes badly neglected (GOODMAN *et al*. 1986). Among these inhibitors only abscisic acid (ABA) may be regarded as a growth inhibitor in higher plants, participating in many important physiological functions (PROCHÁZKA *et al*. 1997). The ability of some saprophytic and parasitic fungi, such as soil micromycetes, to synthesize and secrete ABA into the culture medium is comparatively well known from the current literature. It has been described for such species as e.g. *Cercospora* sp., *Polyporus* sp., *Rhizoctonia* sp., *Schizophyllum commune, Agrocybe praecox, Trametes versicolor, Aspergillus niger, Cladosporium cladosporioides* (ASSANTE *et al*. 1977; CROCOLL *et al*. 1991; DÖRFING & PETERSON 1984; FILOMONOVÁ 1991; JANITOR & VIZÁROVÁ 1994; MICHNIEWICZ *et al*. 1984, 1986; STOPINSKA & MICHNIEWICZ 1988; OKOMOTO *et al*. 1988; VIZÁROVÁ *et al*. 1997).

However, fewer references exist on the role that ABA plays in the processes of growth and development of fungi. At present it is known that ABA stimulates the mycelial growth of *Fusarium culmorum, Cylindrocarpon destructans, Ceratocystis fimbrata, Gloeosporium album* and *Botrytis cinerea* (MICHNIEWICZ *et al*. 1984, 1986; BORECKA & PIENIAŽEK 1968; STOPIŇSKA & MICHNIEWICZ 1988). The present work analyses the effect that ABA has on the growth of *Schizophyllum commune* and *Monilia sp*. cultivated *in vitro*. These fungi also secrete ABA into the culture medium.

MATERIAL AND METHODS

The parasitic fungi *Monilia laxa* Sacc. (isolates ML 11 and ML 34), *M. fructigena* Aderh. et Ruhl. (isolates M6, M21 and M28) and the parasitic saprophytical fungus *Schizophyllum commune* Fr. (isolate Sch 5) which had been isolated from apricot in Slovakia, were used in the experiments.

The fungi were cultured on static liquid medium (LILLY & BARNET 1953) containing 15 g glucose, 0.5 g asparagine, 0.25 g $MgSO_4 \times 7\ H_2O$, 0.75 g KH_2PO_4, 25 mg thiamine and 5 g biotin in 500 ml distilled H_2O (control).

To study the effect of ABA on growth of the mycelium the concentrations 10^{-9}, 10^{-8}, 10^{-7}, 10^{-6} and 10^{-5}M of ABA (Sigma) were filter sterilized (Millipore, size 0.47 µ).

The cultures were inoculated with mycelium on solid medium (five pieces of a cm^2 each per 400-ml Erlenmeyer flask) and incubated at 25°C. After 10 and 15 d of growth, respectively, the mycelia were separated from the medium and their dry weight was measured. The effect of different concentrations of ABA on mycelial growth was statistically evaluated according to LAMOŠ and POTOCKÝ (1989).

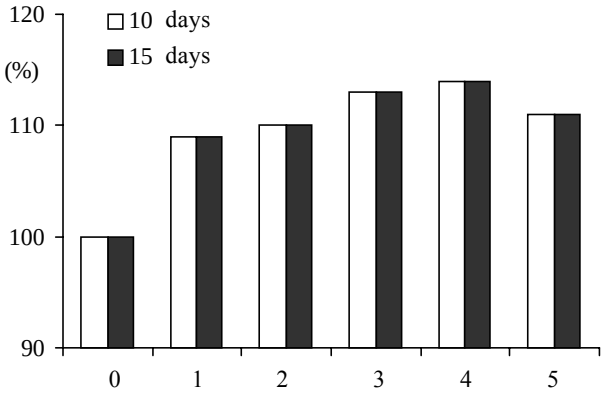
RESULTS AND DISCUSSION

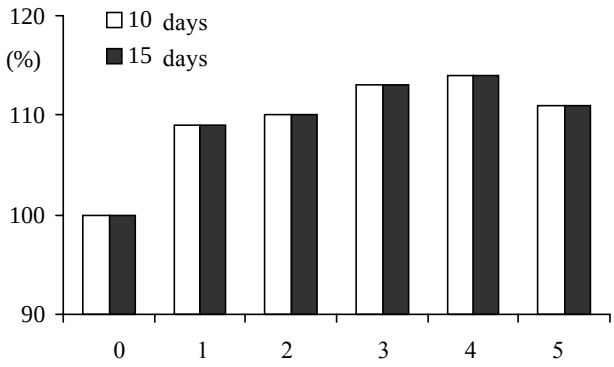
Our study confirmed that ABA stimulates the growth of mycelium of the *Schizophyllum commune* and *Monilia* sp. isolates.

Sch. commune was sensitive to all concentrations of ABA used. Higher concentrations of ABA (10^{-5} and 10^{-6}M) showed little stimulatory effect compared to the concentrations 10^{-7}, 10^{-8} and 10^{-9}M, with 10^{-8}M giving maximum stimulation. Fig. 1 shows the results after 10 and 15 d of culture.

The two isolates of *Monilia laxa* gave almost the same response as *Sch. commune* to the concentrations of ABA (Fig. 2). Both fungi are known to secrete ABA into the culture medium (VIZÁROVÁ *et al*. 1997; JANITOR & VIZÁROVÁ 1994).

The isolates of *M. fructigena* demonstrated even higher sensitivity to all tested concentrations of ABA (Fig. 3). Though the differences between the dry matter of mycelia of *M. laxa* and *M. fructigena* were small, they were significant. Similar results were reported by VASJUK & MUSATENKO (1998) with the phytopathogenic fungus *Septoria tritici* Roberge ex. Dem.





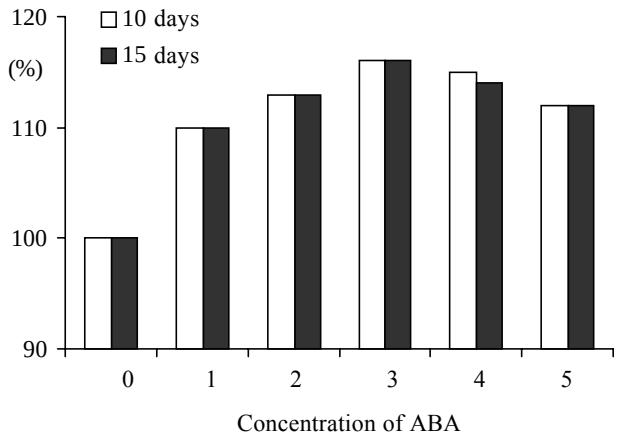
Explanation to Fig. 1–3: 0 = control (100%); 1 = ABA concentration 10^{-5}M; 2 = ABA concentration 10^{-6}M; 3 = ABA concentration 10^{-7}M; 4 = ABA concentration 10^{-8}M; 5 = ABA concentration 10^{-9}M

n = 60; SE = 0.31 significance P = 0.01 for each concentration of ABA

Fig. 1. The effect of abscisic acid (ABA) on mycelial growth of *Schizophyllum commune* on liquid Lilly-Barnet medium, expressed in dry matter of mycelium compared with the control

n = 60; SE = 0.31 significance P = 0.01 for each concentration of ABA. The reaction of all isolates was similar

Fig. 2. The effect of ABA on mycelial growth of *Monilia laxa* on liquid Lilly-Barnet medium, expressed in dry matter of the mycelium compared with the control



n = 60; SE = 0.29 significance P = 0.01 for each concentration of ABA. The reaction of all isolates was similar

Fig. 3. The effect of ABA on mycelial growth of *Monilia fructigena* on liquid Lilly-Barnet medium, expressed in dry matter of the mycelium compared with the control

Our results agree with earlier literature that described the stimulatory effects of low ABA concentrations on fungal growth (e.g. MICHNIEWICZ *et al*. 1984, 1986; STOPINSKA & MICHNIEWICZ 1988). It was also reported that ABA concentrations from 10^{-5} to 10^{-9}M stimulated the growth of mycelium of the soil micromycete *Aspergillus niger* Tiech. (JANITOR & VIZÁROVÁ 2000). We noted that all fungi that have been studied during the last years for the effect of ABA on mycelial growth, also secrete ABA into the culture medium.

The data presented in the figures clearly show the positive and stimulatory influence of ABA on fungal growth, contributing to the general knowledge of this aspect. At the same time, it is known that ABA inhibits growth and development of higher plants, negatively influencing their metabolic processes (PROCHÁZKA *et al*. 1977).

Thus, while the production of ABA by phytopathogenic fungi positively influences their own growth, the secretion of ABA into plants during pathogenesis is detrimental to the attacked plants. Both actions combined appear to constitute a factor in pathogenicity.

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Súhrn

JANITOR A. (2002): **Rast mycélia fytopatogénnych húb po aplikácii kyselina abscisovej v podmienkach *in vitro***. Plant Protect. Sci., **38**: 94–97.

Študovali sme vplyv kyseliny abscisovej (ABA) na rast mycélia fytopatogénnych húb *Schizoplyllum commune*, *Monilia laxa* a *Monilia fructigena* v podmienkach *in vitro*. Všetky koncentrácie ABA (od 10^{-5} do 10^{-9}M) stimulovali rast mycélia uvedených

húb v Lilly-Barnetovom výživonom médiu. Pokusy sme vyhodnocovali po 10 a 15 dňoch. Výsledky nasvedčujú, že sékrécia kyseliny abscicovej môže zohrávať významnú úlohu v procese patogenézy.

Kľúčové slová: *Schizophyllum commune*; *Monilia laxa*; *Monilia fructigena*; rast mycélia; podmienky *in vitro*; kyselina abscisová

Corresponding author:

Ing. ANTON JANITOR, PhD., Ústav experimentálnej fytopatológie a entomológie, Nádražná 52, 900 28 Ivanka pri Dunaji, Slovenská republika
tel.: + 421 2 45 943 251, fax: + 421 2 45 943 431, e-mail: uefedire@savba.sk