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INITIAL RESEARCH ON THE EFFECT OF THE NANOGRO PLANT GROWTH STIMULATOR ON *Fusarium culmorum* (W.G. Smith) Sacc.

WSTĘPNE BADANIA NAD WPŁYWEM STYMULATORA WZROSTU ROŚLIN NANOGRO NA *Fusarium culmorum* (W.G. Smith) Sacc.

Abstract: An *in vitro* experiment determined the effect of the Nanogro plant growth and development stimulator, newly introduced in Poland, on *Fusarium culmorum* (W.G. Smith) Sacc. phytopathogenic fungus. A modification of linear growth and sporulation of *F. culmorum* mycelium caused by Nanogro was observed after the contact with the fungus spores, vegetative mycelium and the added medium. In the experiments where limited linear growth of Nanogro was observed as a result, stimulation of mycelium sporulation occurred the most frequently. The application of Nanogro in practice will not contribute to limiting the harmfulness of this pathogen.

Keywords: *F. culmorum*, Nanogro, linear growth, sporulation

Research on agro-homeopathy has been conducted worldwide and preparations with ultra low content of elements or chemical compounds positively affecting growth and development of plants have been introduced to the agro-market. Scientific research on agro-homeopathy revealed a positive effect of ultra-low concentrations of the substances selected for the experiments on the growth of various plants, particularly during germination [1–7]. Like medical homeopathy, also agro-homeopathy has both supporters and opponents [8].

Nanogro, a plant growth and development stimulator, was first marketed in Poland in 2007 as one of the few agro-homeopathic products. The preparation consists of oligosaccharide granules (pellets) saturated with metal sulphates (Fe, Co, Al, Mg, Mn, Ni and Ag) in nanomolar concentrations. Nanogro is recommended for treatment and

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watering agronomic and horticultural plants, which according to its producer causes an increase in yields, more exuberant plant development, shortens vegetation and improves plant viability and vigour.

Fungi of the *Fusarium* genus are dangerous cosmopolitan pathogens of crops. Diseases caused by these fungi lead not only to a decline in yield and its parameters but also worsens its quality due to the presence of micotoxins dangerous for humans and animals. The species dominant in Europe is *Fusarium culmorum* (W.G. Smith) Sacc. [9–12].

The research was conducted to assess the effect of Nanogro on the vegetative mycelium and spores of *Fusarium culmorum*.

Material and methods

F. culmorum strain purchased from the collection of the Plant Protection Institute (the Plant Pathogen Bank), isolated from cabbage was used for the analyses. The experiment was conducted *in vitro* to test the effect of Nanogro on the concentrated spore suspension and vegetative mycelium of *F. culmorum*.

Nanogro in the concentrations recommended by the producer (10 granules per 10 dm^3 of water) and three times increased (30 granules per 10 dm^3 of water) was added to the fungus spore suspension prepared in sterile distilled water. The control was the suspension with the same spore concentration without the Nanogro supplement. The spore suspension was shaken in 300 cm^3 flasks for 81 hours and after 1, 2, 3, 6, 9 and 81 hours some amount of suspension, adequate for further culturing was collected. *F. culmorum* spore suspension was inoculated on Petri dishes with solid PDA medium in 7 replications. The culture was maintained at the temperature of 21 ^oC.

Linear growth of the cultured mycelium was measured. Once the culturing was completed, spore suspensions were prepared of the mycelia discs with a 50 mm diameter and shaken in 100 cm^3 of distilled water. After filtration the spores number was measured in the obtained suspensions using the spectrophotometric method.

The subsequent *in vitro* experiment aimed at an assessment of the effect of Nanogro on *F. culmorum* vegetative mycelium. Mycelial discs with a 5 mm diameter from the Department's own collection were inoculated on Petri dishes with solid PDA medium. Nanogro solutions were prepared in sterile distilled water (10, 20 and 30 granules per 10 dm^3 of water). Subsequently, 30 mm^3 (μl) of the solution was dripped with a micropipette onto the discs inoculated on the Petri dishes. 7 replications were made for each Nanogro concentration, whereas the fungus culture from discs dripped with sterile distilled water constituted the control. The culture was maintained and mycelial linear growth was measured until sporulation was obtained, which was assessed as presented above.

The effect of Nanogro supplied to PDA medium in the concentration of 10 granules per 10 dm^3 was also tested. As in the other experiments, assessed were mycelia linear growth and its sporulation after culturing. The control was the culture maintained on the standard PDA medium. The obtained results were verified statistically.

Results and discussion

Figures 1 and 2 present the results obtained in the experiment assessing the effect of Nanogro on *F. culmorum* spores. After 1, 2, 3, 6 and 9-hour spore contact with the preparation in the concentration recommended by the producer (10 granules per 10 dm^3)

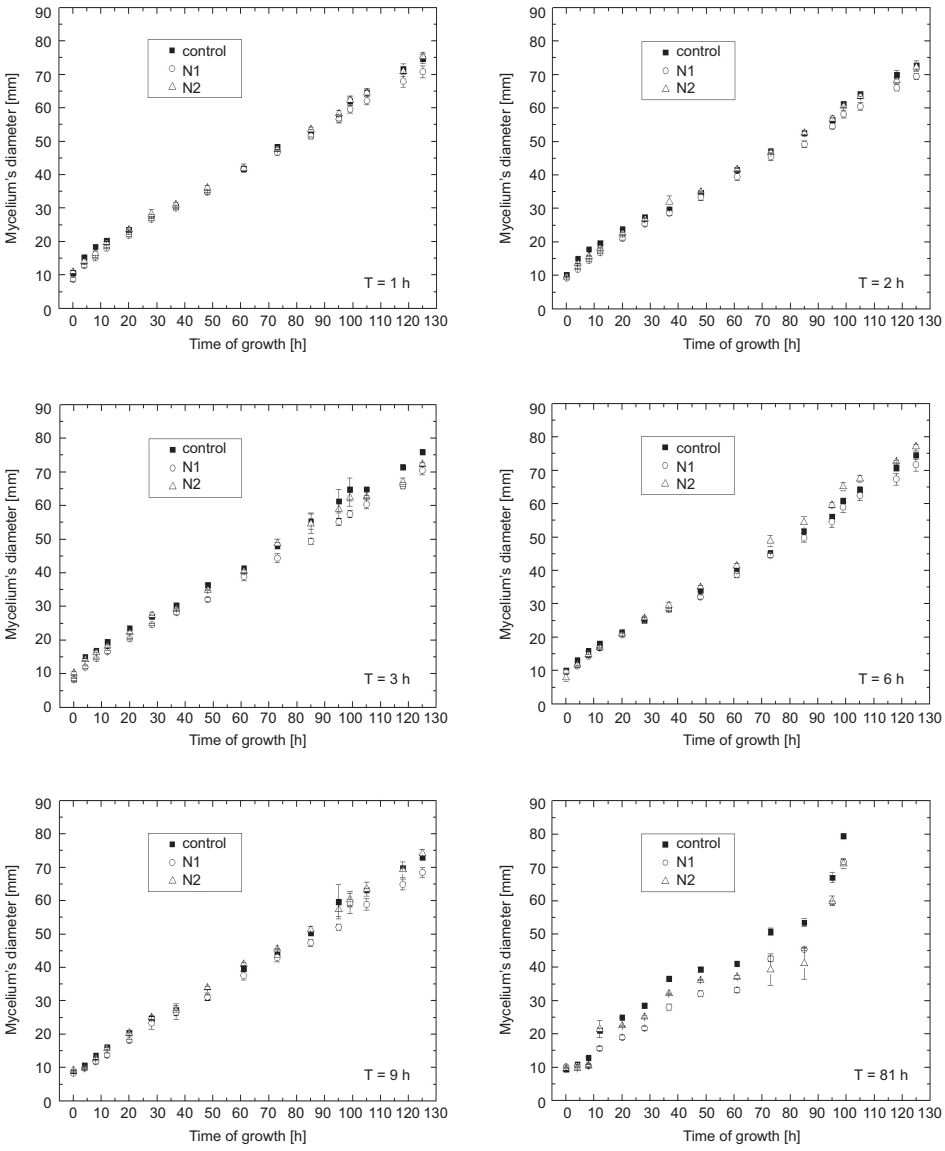

Fig. 1. The effect of Nanogro on *F. culmorum* spores expressed by linear growth in consecutive culturing after contact (T) with preparation in the concentrations of 10 granules per 10 dm^3 (N1) and 30 granules per 10 dm^3 (N2)

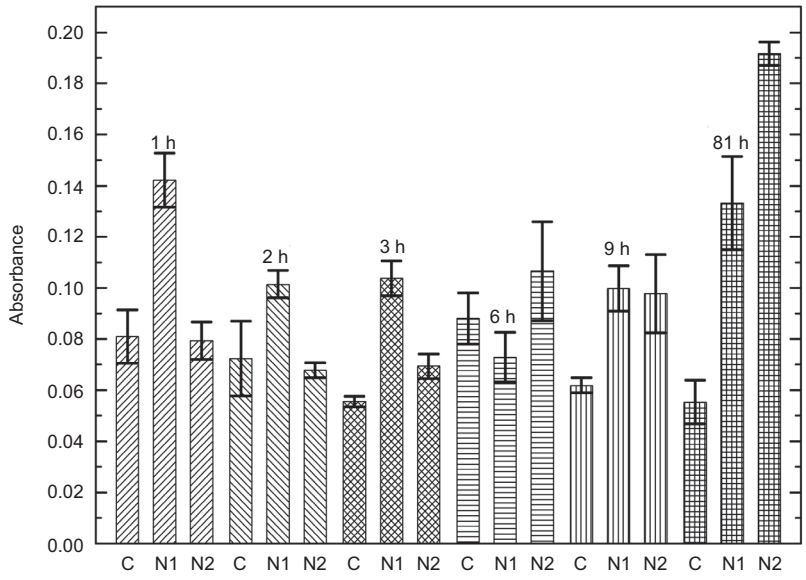

Fig. 2. The effect of Nanogro on *F. culmorum* spores expressed by mycelial sporulation obtained in consecutive culturing after contact with the preparation (1, 2, 3, 6, 9 and 81 h) in concentration of 10 granules per 10 dm^3 (N1) and 30 granules per 10 dm^3 (N2), c – control

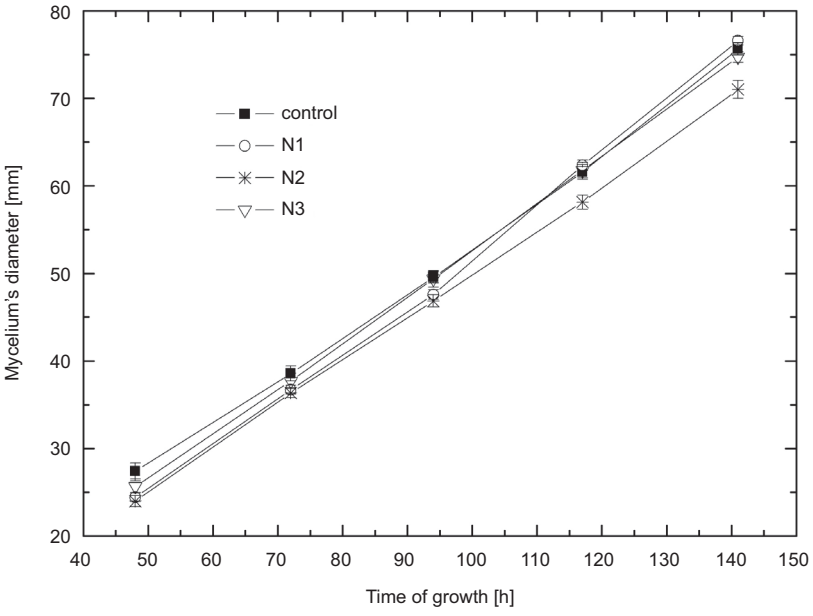

Fig. 3. The effect of Nanogro on *F. culmorum* vegetative mycelium growth, applied Nanogro concentrations: 10 granules per 10 dm^3 (N1), 20 granules per 10 dm^3 (N2) and 30 granules per 10 dm^3 (N3)

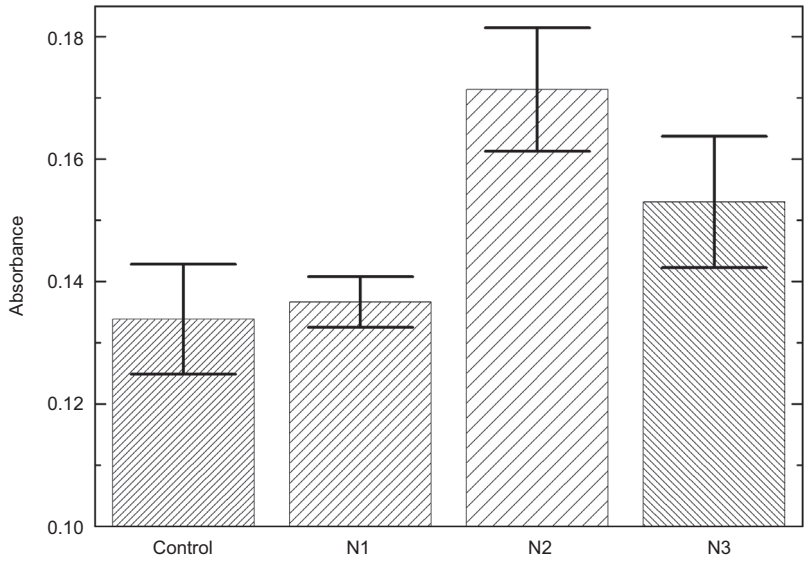

Fig. 4. The effect of Nanogro applied on vegetative mycelium on sporulation obtained in consecutive culturing. Applied Nanogro concentrations: 10 granules per 10 dm^3 (N1), 20 granules per 10 dm^3 (N2) and 30 granules per 10 dm^3 (N3)

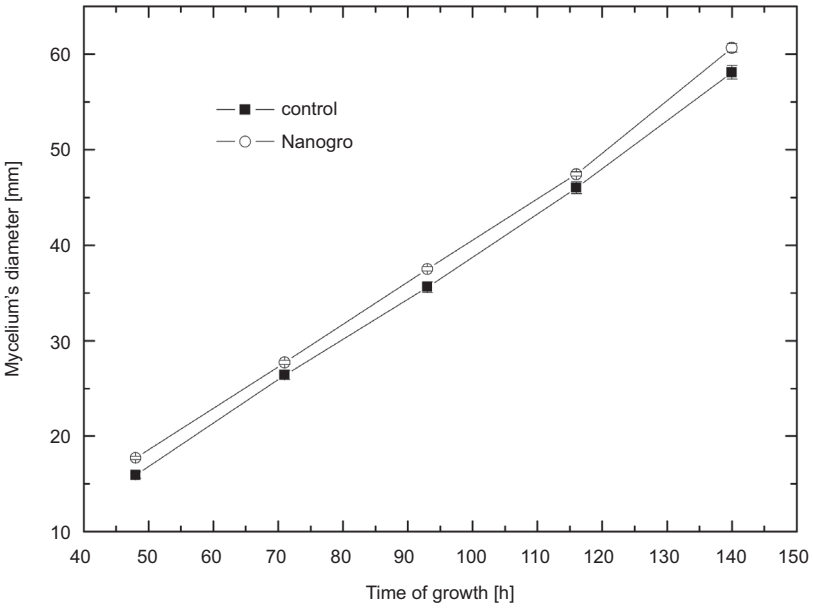

Fig. 5. The effect of Nanogro supplied to the medium in concentration of 10 granules per 10 dm^3 on *F. culmorum* linear growth

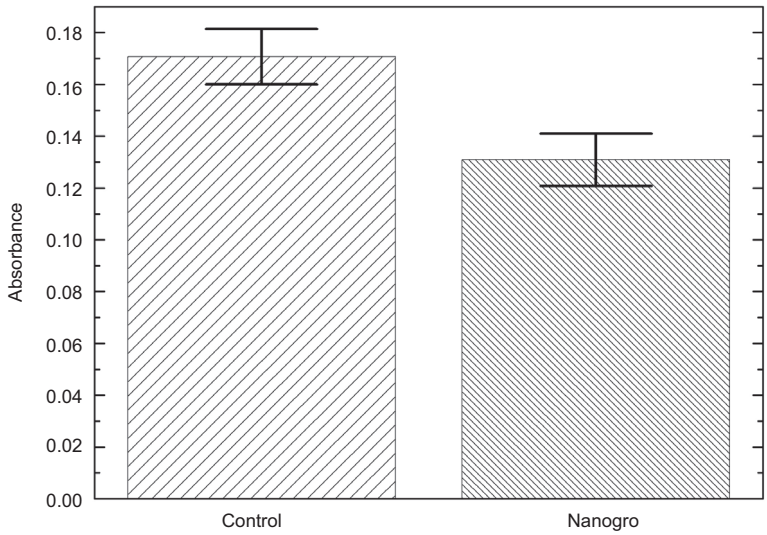

Fig. 6. The effect of Nanogro supplied to the medium in the concentration of 10 granules per 10 dm^3 on *F. culmorum* sporulation

a slight reduction of linear growth of mycelium cultured from spores was revealed in comparison with the control (Fig. 1), which was not registered for the higher concentration (30 granules per 10 dm^3). The longest (81 h) spore contact with the preparation in both applied concentrations significantly limited the fungus growth in the consequent culturing. The analyzed mycelia sporulation after culturing (Fig. 2) evidences that despite limiting mycelia linear growth, Nanogro affects the strong stimulation of *F. culmorum* sporulation.

The results obtained from the experiment on the effect of Nanogro on *F. culmorum* vegetative mycelium show that only in the concentration of 20 granules per 10 dm^3 of water the preparation significantly limits the linear growth of the pathogen mycelium in comparison with the control (Fig. 3). Like in the experiments on spores, Nanogro in the concentration limiting the linear growth caused a markedly greater mycelium sporulation (Fig. 4).

On the other hand, Nanogro supplied to the medium slightly stimulated linear growth of *F. culmorum* (Fig. 5) in comparison with the control and significantly limited mycelium sporulation obtained in culturing on this medium (Fig. 6).

The obtained results demonstrated that Nanogro modifies linear growth and sporulation of *F. culmorum* – a dangerous crop pathogen. However, no fungistatic effect of Nanogro was registered, whereas practical application of this preparation will contribute to limiting this pathogen harmfulness.

References

[1] Betti L., Brizzi M., Nani D. and Peruzzi M.: Brit. Homeopath. J. 1994, **83**, 195–201.
[2] Bornoroni C.: Berlin J. Res. Homeopath. 1991, **1**, 275–278.

[3] Hamman B., Koning G. and Lok Him K.: Homeopathy 2003, **92**, 140–144.
[4] Jones R.L. and Jenkins M.D.: Brit. Homeopath. J. 1981, **70**, 120–128.
[5] Jones R.L. and Jenkins M.D.: Brit. Homeopath. J. 1983, **72**, 143–147.
[6] Pelikan W. and Unger G.: Brit. Homeopath. J. 1971, **60**, 232–266.
[7] Pongratz W., Endler P.C.: Ultra High Dilution, Physiology and Physics, Kluwer Academic Publishers, Dordrecht 1994, 19–26.
[8] Scofield A.M.: Biol. Agric. Hortic. 1984, **2**, 1–50.
[9] Gang G., Miedaner T., Schuhmacher U., Schollenberger M. and Geiger H.H.: Phytopathology 1998, **88**, 879–884.
[10] Hestbjerg H., Felding G. and Elmholt S.: J. Phytopathol. 2002, **150**, 308–316.
[11] Parry D.W., Jenkinson P. and McLeod L.: Plant Pathol. 1995, **44**, 207–238.
[12] Wagacha J.M. and Muthomi J.W.: Crop Protection 2007, **26**, 877–885.

WSTĘPNE BADANIA NAD WPŁYWEM STYMULATORA WZROSTU ROŚLIN NANOGRO NA *Fusarium culmorum* (W.G. Smith) Sacc.

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Abstract: W doświadczeniu *in vitro* określono wpływ nowego w Polsce stymulatora wzrostu i rozwoju roślin Nanogro na grzyb fitopatogenny *Fusarium culmorum* (W.G. Smith) Sacc. Stwierdzono modyfikację wzrostu liniowego i zarodnikowania grzybni *F. culmorum* wywoływane przez Nanogro po kontakcie z zarodnikami grzyba, grzybnią wegetatywną, jak i dodanego do podłoża hodowlanego. W doświadczeniach, gdzie pod wpływem Nanogro obserwowano ograniczenie wzrostu liniowego, występowała najczęściej stymulacja sporulacji grzybni. Stosowanie Nanogro w praktyce nie przyczyni się do ograniczenia szkodliwości tego patogenu.

Słowa kluczowe: *F. culmorum*, Nanogro, wzrost liniowy, zarodnikowanie