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COMPOUNDS MODIFYING IAA-OXIDASE ACTIVITY AS FACTORS THAT INFLUENCE THE CEREAL APHID BIOLOGY

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Abstract. The influence of cinnamic acid, l-tryptophane, 3,4-dihydroxyphenylalanine, 2,4-dichlorophenol modifying IAA-oxidase activity and indoleacetic acid on the development and reproduction of cereal aphids in laboratory conditions was tested. We observed that IAA and Try stimulated the reproduction of cereal aphids whereas CA, DOPA and DCP decreased it.

Key words: cereal aphids, IAA-oxidase activity modificators

I. INTRODUCTION

Application of some derivatives of phenoxyacetic acids on cereal crops increases a reproduction of cereal aphids. Differences in number of cereal aphids between untreated and herbicide-treated plants are considerable (Giebel et al. 1998). One of the factors causing this phenomenon is the IAA level in plant (Bur 1985) which can be modified by the biosynthesis inhibitors or activators of IAA-oxidase. Some phenols, which level changes when the phenoxyacetic acids or triazine herbicides are used (Giebel, et al.1998, Giebel 2000), could play this role. Surico (1992) suggested that IAA-oxidase activity may influence the processes of resistance in relation to plant-parasite. Studies concerning aphid development and physiological status quo of host plant led to selection over hundred biological active compounds, which influenced the development of herbivorous insects (Singh 1970). The role of these compounds as well as their influence on the development of pests is the subject of many researches. Our studies referred the influence of some of them on the development of cereal aphids.

II. MATERIALS AND METHODS

The influence of the selected factors that are able to modify auxine level in plant and in this way they may affect the development of *Sitobion avenae* and *Rhopalosiphum padi* was tested. Seedlings of spring wheat and ears of spring and winter wheat were placed in tubers with the 0.1 mM solution of L-tryptophane (Try), indoleacetic acid (IAA), cinnamic acid (CA), 3,4-dihydroxyphenylalanine (DOPA) or 2,4-dichlorophenyl (DCP). One aphid of *S. avenae* or five aphids of *R. padi* were put on a plant in 5 repetitions in two series, and then the aphid number was counted every day. The results are showed as an average number of cereal aphids obtained from all series after 7 days of rearing. Untreated plants were placed in water. Insect rearing was carried on in climatic cabin under controlled conditions: 16/8 hrs-light/dark, 20±1°C, 60-70% humidity.

III. RESULTS AND DISSCUSION

The number of *R. padi* feeding on wheat seedlings enriched in IAA and 2,4D increased twice after seven days in relation to check test (Fig.1). This finding confirms earlier observation (Giebel et al. 1998) when these compounds significantly stimulated *S. avenae* and *R. padi* reproduction. Scheurer (1986) described similar occurrence. In his experiments the phenoxy acids already in low concentration were able to increase the number of the *Aphis fabae* three times. He concluded that it was connected with the decomposition of plant proteins and starch. Low-molecular compounds, i.e. monomers, which are formed here, might stimulate insect reproduction, especially of suction species.

Indoleacetic acid and its precursor tryptophane, in the majority (Figs. 2, 3 and 5) stimulated the *R. padi* and *S.avenae* number. It is evident among *S. avenae* feeding on ears of winter wheat (Fig. 3). The IAA did not show any effect when the aphids fed on spring-wheat ears (Fig. 4).

Duspiva (1954) showed that the salivary glands of *Aphididae* were able to produce IAA from tryptophane. On the other hand, indoleacetic acid affected development and reproduction of *A. fabae* and other aphid species. But, this plant growth hormone added to holidic diets showed only slight effect on aphids (Bur 1985).

A role of IAA in aphid's development is strengthen by the effect of IAA-oxidase promoters, i.e. cinnamic or 2,4-dichlorophenol. This activity leads to the reduction of number of the aphids as it is showed in Fig. 5. This tendency is presented in Figs. 3 and 4. It was not unlikely that these compounds could activate peroxidase in aphid organism if they were taken during a feeding. It can lead to the reduction of the IAA level and in this way the

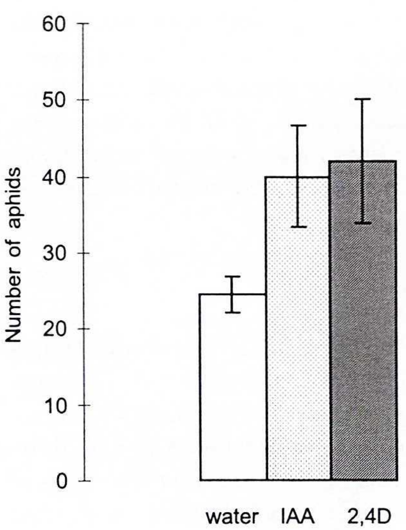

Fig. 1. Average number *R. padi* feeding on seedlings of spring wheat dipped in 0.1-mM solutions of IAA and 2,4D after 7 days

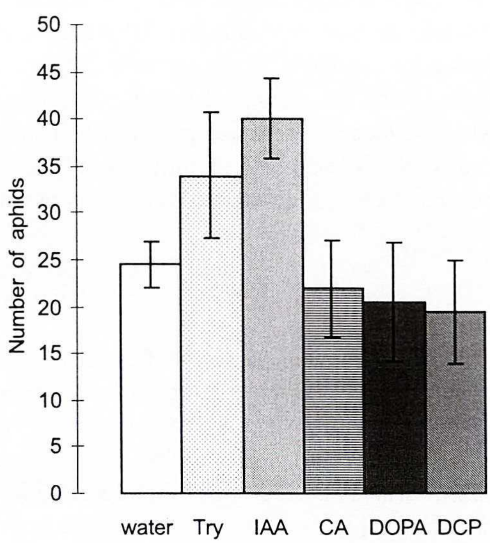

Fig. 2. Average number of *R. padi* feeding on seedlings of spring wheat dipped in 0.1-mM solutions of Try, IAA, DOPA and DCP after 7 days

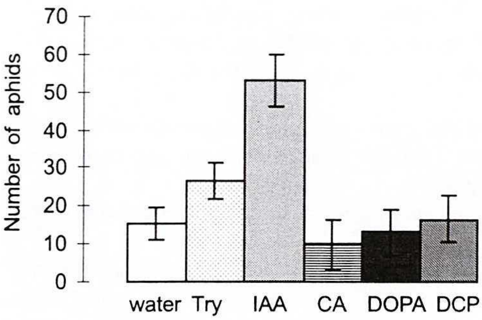

Fig. 3. Average number of *S. avenae* feeding on ears of winter wheat dipped in 0.1-mM solutions of Try, IAA, DOPA and DCP after 7 days

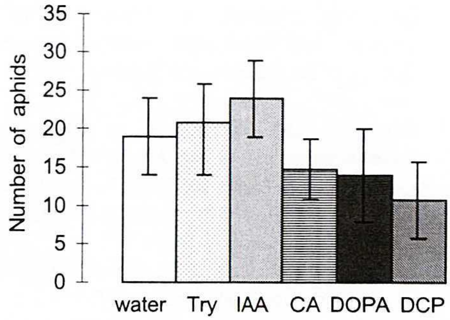

Fig. 4. Average number of *S. avenae* feeding on ears of spring wheat dipped in 0.1-mM solutions of Try, IAA, DOPA and DCP after 7 days

physiological processes of aphids would be disturbed.

The presence of the natural inhibitors or promoters of IAA-oxidase activity in plants can influence the aphid progress and behaviour. It was observed while the oxidase -inhibitor level in wheat plants after phenoxy acid treatment was tested. We found in consequence an increase of the level of this inhibitor as well as the number of *R. padi* and *S. avenae* (Giebel et al.1998). Likewise Scheurer (1986) attributed the plant phenols to an ability of modify the indoeacetic acid activity in relation to aphid species. Such interdependence has good reference in relation to many parasites and diseases (Giebel 1982; Bell 1974; Hedin et al.1974).

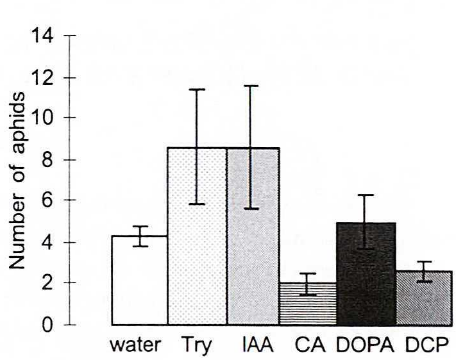

Fig. 5. Average number of *S. avenae* feeding on seedlings of spring wheat dipped in 0.1-mM solutions of Try, IAA, DOPA and DCP after 7 days

IV. LITERATURE

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ZWIĄZKI CHEMICZNE MODYFIKUJĄCE AKTYWNOŚĆ OKSYDAZY IAA JAKO CZYNNIKI WPŁYWAJĄCE NA BIOLOGIĘ MSZYC ZBOŻOWYCH

STRESZCZENIE

Testowano, w warunkach laboratoryjnych, wpływ kwasu cynamonowego, l-tryptofanu, 3,4 dwuchlorofenyloalaniny i 2,4-dwuchlorofenolu (związków modyfikujących aktywność oksydazy kwasu indolooctowego) na rozmnażanie się mszyc zbożowych.

Stwierdzono, że IAA i Try stymulował ten proces, natomiast pod wpływem CA, DOPA i DCP obserwowano zmniejszenie intensywności rozmnażania się mszyc zbożowych.