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CHANGES IN ACTIVITY OF LYSINE DECARBOXYLASE IN WINTER TRITICALE IN RESPONSE TO GRAIN APHID FEEDING

SHORT COMMUNICATION

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Changes in lysine decarboxylase (LDC) activity caused by *Sitobion avenae* (F.) feeding on two winter triticale cultivars (cvs) were studied. The aphid fecundity and values of intrinsic rate of natural increase showed that cv Witon was less susceptible to *S. avenae* than cv Tornado. The grain aphid feeding on more susceptible triticale caused a decrease in the LDC activity, with exceptions of root tissues after two weeks of the feeding. In case of less susceptible cv Witon reduction of the LDC activity was observed only during initial period of *S. avenae* feeding. Later the aphid infestation induced activity of the LDC within tissues of cv Witon.

Keywords: Lysine decarboxylation – cadaverine biosynthesis – insect-plants interactions – *Sitobion avenae – Triticosecale*

Lysine decarboxylase (LDC; EC 4.1.1.18) is a key enzyme in biosynthesis of polyamines present in Poaceae, Fabaceae and Solanaceae [1]. Berlin et al. [2] stated that LDC in cell cultures of tobacco accelerated biosynthesis of alkaloid anabasine and formation of hydroxycinnamic acid amides (HCAAs) of cadaverine. Although there are only few data about polyamines participation in aphid-plant interactions it is know that plant responses caused by sap-feeding insects (i.e. Homoptera) may change polyamine content and metabolism [3]. It is also well known that they are connected with wounding of epidermis, mesophyll, and parenchyma by the aphid's stylets penetration [4]. Our previous works showed that aphid feeding caused changes in polyamines accumulation and modulation of activity of key enzymes of their biosynthesis [8, 9]. However, the problem needed further investigations of detailed mechanisms of these interactions. The present paper reports on changes in activity of the lysine decarboxylase in relation to duration of the grain aphid (*Sitobion avenae* Fabricius).

All experiments were carried out in environmental chamber at 24 °C at day and 18 °C at night, 70% relative humidity and photoperiod 16L:8D. Two cultivars of winter triticale (*Triticosecale*, Wittm. ex A. Camus): Tornado and Witon obtained

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from Plant Breeding and Acclimatization Institute (IHAR) in Strzelce near Łódź (Poland) and parthenogenetic clone of *S. avenae* reared on winter triticale seedlings were used in the experiments. Population tests were conducted according to Leszczyński et al. [5]. The experiments were run in 25 independent replicates for each of the studied triticale cultivars. The aphid prereproductive period and daily fecundity were estimated. An intrinsic rate of natural increase (r_m) and mean time of generation development (T) were calculated after Wyatt and White [10].

The seven-day-old seedlings of the triticale were artificially infested with 5 wingless females of *S. avenae* and isolated with Plexiglas cages with a cheese cloth cover. Infested and control seedlings (without aphids) were collected after one day, one week and two weeks of the aphid feeding and aphid number was determined on five randomly selected shoots. LDC activity was assayed according to Phan et al. [7] and expressed in μM of cadaverine generated during 1 hour by 1 mg of enzymatic protein, estimated according to Lowry et al. [6].

Results obtained showed that the aphids settled on cv Witon were characterized by significantly lower daily fecundity and intrinsic rate of natural increase then individuals from cv Tornado (Table 1). *S. avenae* feeding on cv Tornado caused decrease of

Table 1
Values of the population parameters (means ± standard error) of the grain aphid on the studied winter triticale cultivars

Parameters	Cultivar		U_{25}	*P*
	Tornado	Witon		
Prereproductive period (days)	7.84±0.32	8.32±0.40	280.50	0.53
Daily fecundity per female	3.97±0.34	2.50±0.32	148.00	<0.01
Mean time of generation development (T) (days)	10.64±0.44	11.24±0.53	276.50	0.48
Intrinsic rate of natural increase (r_m)	0.31±0.00	0.25±0.00	4.00	<0.01

Results of Mann-Whitney U-test also presented.

the LDC activity within aerial parts and roots with example of root tissues after two weeks of feeding (Fig. 1). In case of cv Witon the aphid attack reduced the LDC activity during an initial period of the infestation. The LDC induction within root tissues was much stronger within the cv Witon and appeared one week earlier than the cv Tornado roots. These changes revealed difference in responses of triticale cultivars to the grain aphid feeding. It is likely that the observed responses of the studied cultivars may be dependent on genotype of the triticale. Induction of the enzyme activity in less susceptible cv Witon after one week in root tissues and after two weeks within shoots, may have accelerated metabolic reactions and caused disturbances in equilibrium between lysine content and cadaverine level, as the product of amino acid decar-

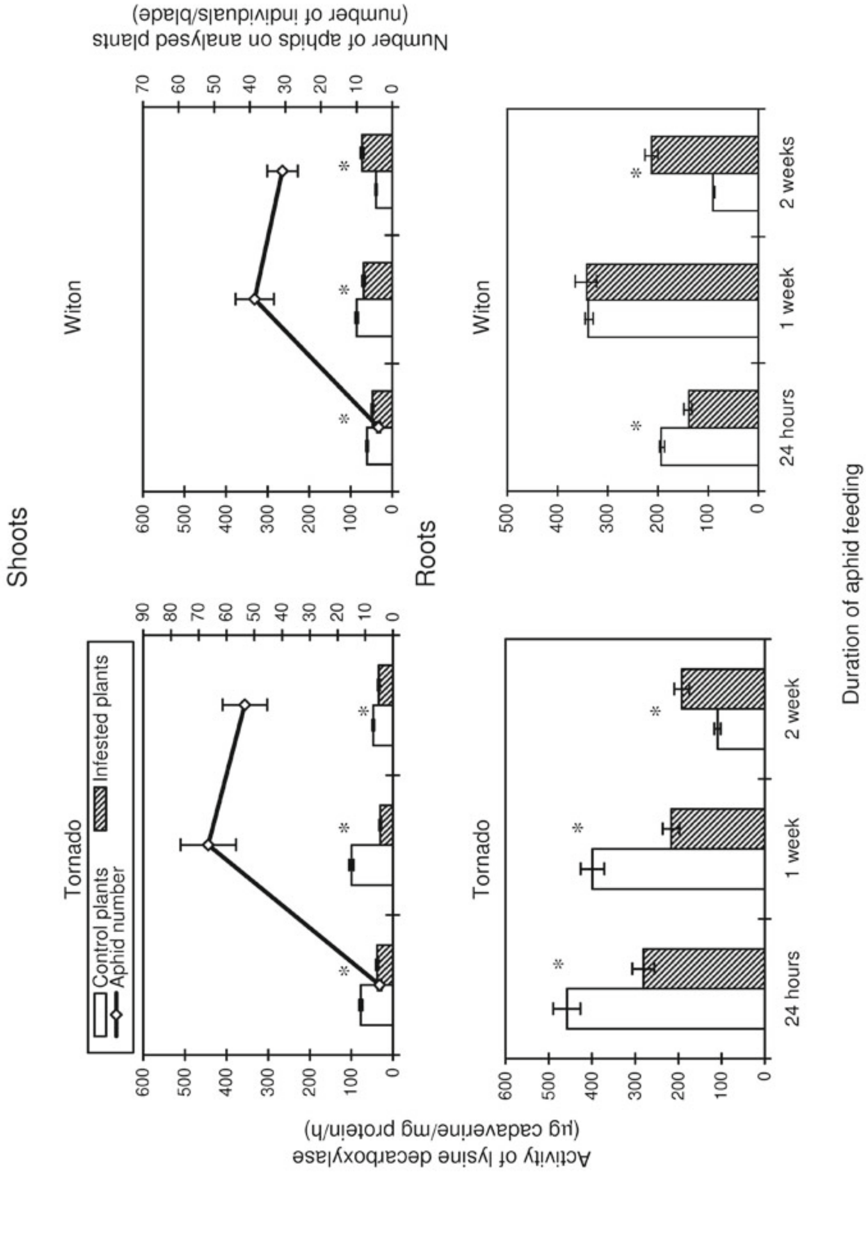

Fig. 1. Influence of the grain aphid feeding on activity of the lysine decarboxylase within tissues of the studied triticale cultivars. Result of Mann-Whitney U-test also presented: *differences between control and infested plants significant at $P \leq 0.05$

boxylation. Such changes caused a decrease in nutritive value of the cv Witon tissues for the grain aphid. In addition, changes in LDC activity within triticale seedlings infested by aphids showed a systemic character, since the enzyme activity varied not only in the directly attacked site, but also within the root tissues.

Summing up, the obtained result suggests that biosynthesis of the polyamines within the triticale tissues might be involved in defence mechanism towards sucking-piercing grain aphid. However, further study is needed to focus on role of the free polyamines and their HCAAs derivatives in chemical interactions between cereals and aphids.

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