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REGRESSIONAL PATTERNS OF SHORT CELLS DEVELOPMENT IN THE GLUMELLAE ABAXIAL EPIDERMIS IN *AVENA FATUA* L.

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Abstract. The different development of short cells in the abaxial epidermis of lemma versus palea was discovered in a wild oat, *Avena fatua*. A developmental pattern presented in the form of a linear regression shows, that in palea, cytokineses creating papillae and cell duplexes are highly correlated and that such a correlation does not exist in lemma.

Key words: *Avena fatua*, glumellae, abaxial epidermis development, regression

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Introduction

Cells of various morphology and function are developed in epidermis which covers all plant organs. The most remarkable cells are those creating stomata. In grasses, the abaxial epidermis is highly differentiated on some organs such as glumes and glumellae. Its microstructural characteristics have been used in the variation study of numerous grasses. Many patterns of variation have been discovered, for instance: uniparental dominance in amphiploids of Triticeae Dumort. (Kosina 1996a), interspecific variation in wheat (Kosina 1999a) or intersectional differences in the genus *Bromus* L. (Kosina 1999b). Correlations of epidermis characters in *Bromus* and *Brachypodium* P. Beauv. were similar, but the meristemoidal pattern of this tissue was different (Kosina 1996b, 1997). Frequency of meristemoidal events in both glumellae, lemma and palea, is different and probably depends on vascular bundles, of which there are several in lemma and only two in palea. Parry & Smithson (1966) described many types of silica phytolits in grasses. They are stored in several forms of short epidermal cells, such as silica cells, cork cells, papillae, hooks or short or long hairs. Long epidermal cells with sinusoid anticlinal walls are less differentiated. In grasses, leaf expansion is more dynamic at the base of an organ, where more cytokineses occur (Steeves & Sussex 1989). Such development is visible well in glumellae, where more short cells are created at the base. Determination of the cell shape, long *versus* short, created by an additional anticlinal cytokinesis, probably depends on the underlying tissue. The cytokinesis can occur upon an underlying cell or upon an intercellular space (Lyndon 1990).

Material and methods

One accession of *Avena fatua* L. was collected in the cultivated field of *A. sativa* L. in the vicinity of Wrocław, SW Poland. Seeds were resown in the grass collection maintained by the first author. A large random sample of diaspores (n = 100) was chosen for a study of varnish replicas of the abaxial epidermis from lemma and palea. The replicas were observed under an Amplival microscope and frequency of short cells was noted. Two kinds of dominating short cells, papillae and duplexes composed of silica and cork cell were counted. Regressional interrelations between the development of the papillae and duplexes were shown in the form of regression diagrams. The linear and curvilinear regressions were tested. Statistics were calculated with the use of KWIKSTAT 4 software (Elliott 1994).

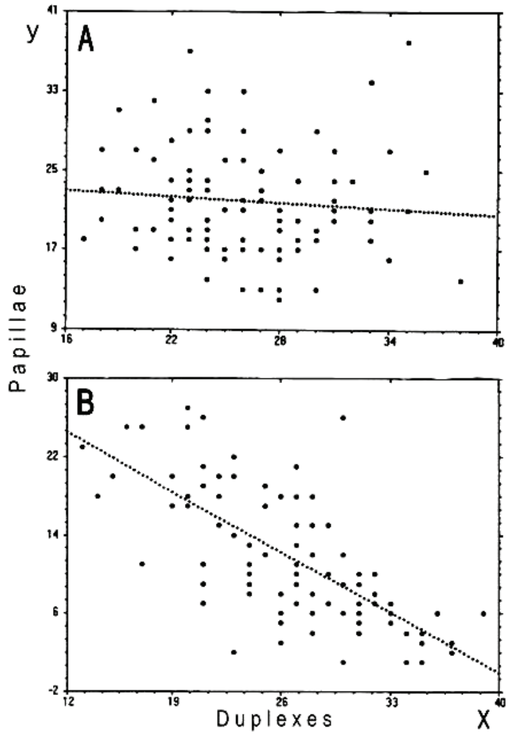

Fig. 1. A regressional pattern of abaxial epidermis development in lemma (**A**) and palea (**B**) of *Avena fatua*, illustrated by a frequency of duplexes (*x*-axis) *versus* papillae (*y*-axis).

Results and discussion

A short epidermal cell called papilla is formed after one anticlinal cytokinesis occurring at one end of the epidermal long cell with sinusoid anticlinal walls. The papilla has a pyramid shape. The development of a duplex, silica cell + cork cell, needs an additional cytokinesis. More papillae *versus* duplexes signify a lower meristemoid activity in the epidermis, and *vice versa*, more duplexes means higher activity of the tissue.

A linear regression appeared more suitable for describing these developmental interrelations than a curvilinear one. Fig. 1 shows linear regression diagrams. For lemma regression, the data are as follows:

$y = 25.54 - 0.10x$ at $R^2 = 0.01$, the level of significance is $p = 0.40$ for the regression variation. The Pearson correlation coefficient is insignificant, $r = -0.09$.

For palea these data are:

$y = 35.11-0.88x$ at $R^2 = 0.50$ the level of significance is $p < 0.001$ for the regression variation. The Pearson correlation coefficient is highly significant, $r = -0.71$.

In the lemma, the development of papillae and duplexes are weakly dependent on each other. In palea both events, creation of papillae *versus* duplexes, replace each other.

The cytokineses creating all short epidermal cells were summarized and considered as the sum of meristemoidal events. This sum is highly positively correlated with the number of duplexes in *Avena fatua*, *A. sativa* and *A. hybrida* Peterm., but negatively correlated in *A. strigosa* (Schreb.) Bonnier et Layens. The correlation between the sum of meristemoidal events and the number of papillae is more variable, especially in different accessions of *A. sativa* and *A. fatua*, sometimes it even does not exist (Warzych 2001).

The above results proved that developmental patterns of abaxial epidermis in oats vary within one organ (flower) of the plant, between accessions (populations) of the same species and between different species. In the genus *Brachypodium*, "a meristemoidal pattern" of lemma abaxial epidermis appeared to be a good taxonomic tool for species discrimination (Kosina 1996b). The same pattern varied significantly between both glumellae in the section *Ceratochloa* (P. Beauv.) Griseb. of the genus *Bromus*. The meristemoidal activity in palea is very low (Kosina 1997). Within the broad biological species *Avena sativa* the pattern discriminates intraspecific types well, however, fatuoidal recombinants appeared to be extremes (Kosina & Bielewicz-Rzepka 2002). The same taxonomic approach to the biological species *A. strigosa* resulted in a compact cluster of *A. strigosa s.str.* while other oat diploids were outside of the cluster (Kosina & Franas 2002).

Interorganal (lemma *versus* palea) and intra- and interspecific variations of abaxial epidermis meristemoidal activity are useful characteristics in developmental and taxonomic studies of various grasses.

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