

Plants and their Pathogens

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Ultrastructural analysis of meristematic cells of fasciated mutant *Pisum sativum* L.

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Fasciation is a phenomenon in which the meristem increases in volume (in some cases – 1000 fold and more). Often this process occurs by increasing of the pool of stem cells in the central zone of meristem. The rate of cell division in the central zone depends on signaling cross talk between the rib-zone and upper layers of the tunica. The detailed ultrastructural analysis allows us to estimate the physiological state of central and rib-zone cells.

There are a lot of studies of fasciation referring to *Arabidopsis thaliana* mutants *clavata* 1,2,3 [1]. However by the moment fasciated mutants of pea (*Pisum sativum* L.) are investigated insufficiently [2].

In our work we used seedlings of two isogenic lines of pea (*Pisum sativum* L.): fasciated mutant ("Shtambovyj") and wild type (cultivar "Nemchinovskij."). Meristems were sampled at early stages of development (1st, 4th and 9th day after germination).

In previous investigation it was revealed that fasciated mutants develop their traits when the 5th leaf emerges [3]. The scanning electron microscopy (SEM) allowed us to find out that at the 1st day of germination seedlings of fasciated mutant "Shtambovyj" the meristem flattens and elongates in comparison with wild-type plants of cv. "Nemchinovskij" (Figure 1).

Then we used transmission electron microscopy (TEM) for investigating of cell ultrastructure in meristems.

In our experiments, it was found that meristematic cells of fasciated plants are extremely vacuolated. This was observed in the rib-zone and in tunica cell layers. Frequently in the central and peripheral zones of tunica cells plasma membranes loose the connection with the cell wall (Figure 3 and 4). In this case, the cell wall in some regions was considerably thinned or undergoes the substantial lysis. In other sites it was strongly thickened. Predominantly cells had a round shape and were arranged as regular rows.

Wild-type plants also had vacuolated cells in the rib-zone (Figure 4). This is probably due to the development of a cavity inside the stem. Cavity formation is typical for *Pisum* stems. But in wild type meristems vacuolization in tunica have not been found, unlike the mutant plants.

All these results allow us to draw a preliminary conclusion that the fasciation in pea may cause defects in the thickening of the cell wall and some mechanical strain and deformation.

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1. S.E. Clark, M.P. Runnig and E.M. Meyerowitz, *Development*, volume 119, (1993), p. 397-418
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3. V.V. Choob and A.A. Sinjushin, *Russian Journal of Plant Physiology*, volume 59, (2012), p. 530 - 545

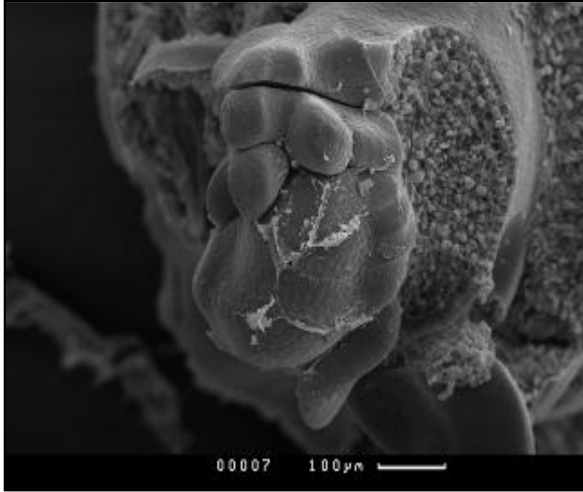


Figure 2. SAM of "Shtambovyj" (1st day after germination)

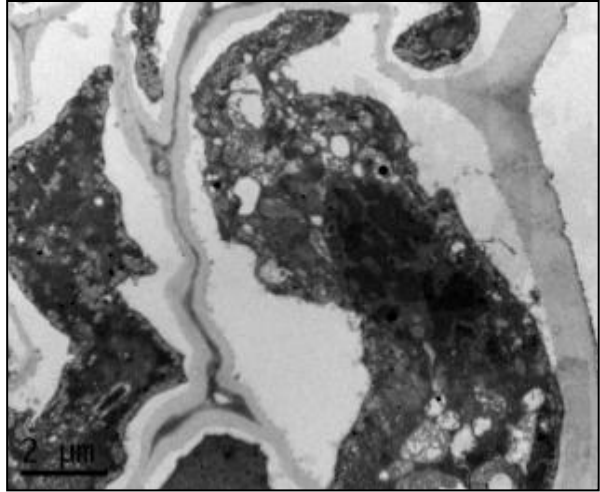


Figure 1. Cells of L1 tunica layer ("Shyambovyj")

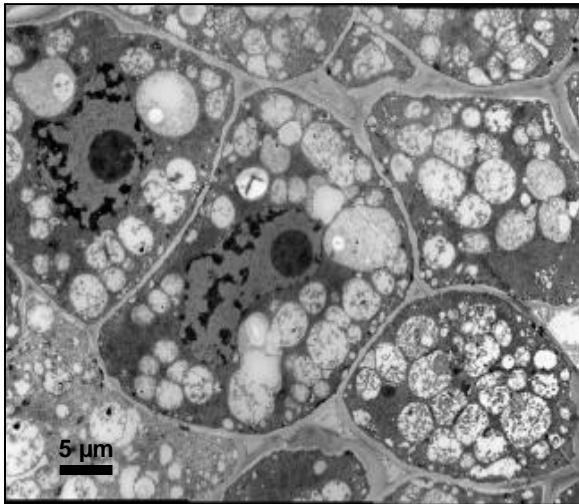


Figure 4. Vacuolated cells of "Shtambovyj"

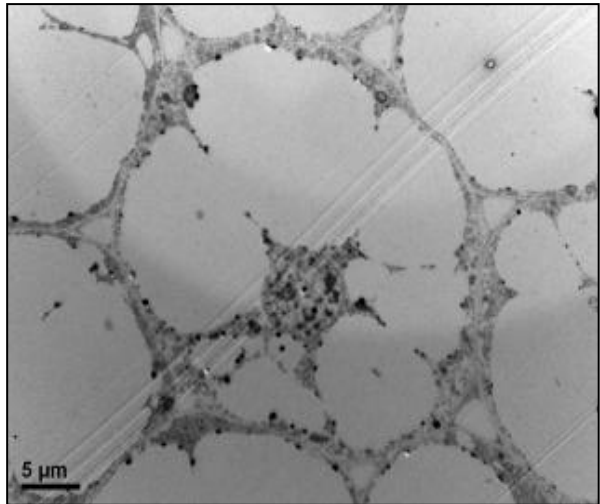


Figure 3. Rib-zone of "Nemchinovskyj"