MORPHO-ANATOMICAL FEATURES OF SOME FRUIT TREES IN CONDITIONS OF TECHNOGENIC POLLUTION OF URBAN ECOSYSTEMS

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ABSTRACT

This article examines the morpho-anatomical features of some fruit trees under the conditions of general pollution of urban ecosystems. An important problem is the establishment of the threshold of toxicological effects, the determination of the relationship between the dose of the toxicant and the response rate of the reaction of the plant organism, in particular, fruit trees, the fruits of which make up the daily diet of the population.

KEYWORDS: *Morpho-Anatomical, Trees, Pollution, Urban, Ecosystem, Toxicant, Reaction.*

INTRODUCTION

The modern highway is a complex system of technical structures designed to ensure high speeds, intensive and safe traffic. Toxic substances released by cars accumulate in growing cultivated plants, and then enter the human body with food. Urban ecosystems, in addition to pollution of the natural environment, include a set of a number of anthropogenic blocks, such as dustiness, gas pollution, high temperature, low air humidity due to asphalt pavement, etc. under conditions of pollution with heavy metals, organic compounds and other toxic substances, they can serve as an effective and economical means of cleaning techno genic and anthropogenically transformed ecosystems (Rusanov, 1968; Abdurakhmanov, Slavkina, 1980; Rakhimov, 1997; Eskarre et al, 200; Toderich et al , 2001; Rahimova, Yadgorova, 2004). In this regard, the study of the role of fruit trees in ensuring the ecological purity of cities and large industrial centers of the republic and the development of a system of biological and chemical monitoring, which allows, on the basis of a comprehensive analysis in the system "environment-soil-plant-cell structures" to assess the state of natural urban ecosystems, acquire special scientific and practical interest. **[1]**

In addition, an important problem is to establish the threshold of toxicological effects, to determine the relationship between the dose of the toxicant and the response rate of the reaction of the plant organism, in particular, fruit trees, the fruits of which make up the daily diet of the population. All this testifies to the special importance of research for the development of scientifically based measures in the field of environmental protection, rational use of natural resources and the introduction of environmental technologies. **[2]**

Literary studies have shown that the use of bio indication properties of various ecological groups of plants greatly facilitates and expands the possibilities of assessing the consequences of techno genic pollution and toxic emissions from industries on the state and functioning of biogeocenoses. The use of a system-integrated approach seems to be useful for conducting biological and chemical monitoring and testing of pollution, as well as bio indication of the state of polluted ecosystems, including urban ones. **[3]**

The aim of the work was to study the morpho-anatomical features of the axial organs of some varieties of fruit trees growing in conditions of different degrees of pollution in urban biotopes.

The experimental part of the work was carried out on two test sites: 1 - with heavy pollution; 2- relatively unpolluted site. When selecting sites, the following was taken into account: the distance from the highway, the number of trucks and cars passing near the sites, as well as soil and climatic conditions, the range of trees and the conditions for their cultivation. The objects of the study were 5 species of widespread fruit trees: common apricot (Armeniaca vulgaris Lam., Variety Supkhani); quince (Cydonia oblonga Mill. Cannery variety); domestic apple (Malus domestica Borkh., Renet Simirenko variety) and ordinary cherry (Cerasus vulgaris Mill., Samarkand variety) from the Rosaceae family, as well as walnut (Juglansregia L, Thin-shelled variety) from the Juglandaceae family. **[4]**

Morpho-anatomical features (the power of the cuticle, wax plaque, the mode of operation of the oral apparatus, etc.) play an important role in the entry of harmful substances into plants. The quantitative morphological and anatomical indicators of the assimilating organs of the fruit tree varieties studied by us are given in Table 1, from which it can be seen that the most significant differences in the morphology and anatomy of the leaf and shoot between the control and experimental plants are characteristic of apple trees.

TABLE 1. ANATOMICAL FEATURES OF QUINCE AND APPLE LEAVES IN DIFFERENT ENVIRONMENTAL CONDITIONS, MICRONS

View		Mesophyll thickness, microns	Epidermal cell height		Number of ostomy ab.epidemiological per 1 mm^2	Attitude h_n/ $h_г$
			Adaxial	Adaxial		
quince	control	172,8±7	15,3±1,43	9,4±0,81	51,8±0,4	0,4±0,30
	experiment	180,4±9*	17,8±1,54*	11,6±1,08*	43,3±0,3***	0,6±0,51*
apple	control	127,2±3	13,6±0,3	9,0±0,82	74,5±0,63	0,8±0,68
	experiment	153,2±4,1*	17,7±1,53**	11,5±1,06*	43,7±3,0***	1,0±0,83*

Note:* p>0,05; **- p<0,05, *** - p<0,001. $h_п$ / $h_г$ – palisade attitude parenchyma to spongy.

Under different growing conditions, trees have a significant difference in the size of leaf tissues [3]. For many species of tree species, an increase in the xeromorphism of the structure of leaves, an increase in the palisade index, and changes in cellular structures are characteristic.

Structural analysis of tissues of apple and quince leaves from different parts of the city shows that such leaves are manifested in varying degrees of cell disruption, depending on the structure of the mesophyll. The mesophyll of quince leaves, having a dorsivetral type, consists of tightly closed 2-3-row palisade cells with small intercellular spaces (Fig. 4), opposite 1-2 rows in control plants (Fig.3, a).

An increase in the cuticle, rows and closeness of the palisade parenchyma largely prevents the penetration of pollutants, and in such conditions plants with an increased height of epidermal cells, mesophyll thickness and an insignificant number of stomata per 1 mm2 on the abaxial side of the leaf adapt. In a quince on the experimental site, a hypostomatous arrangement of stomata is observed (on the abaxial epidermis).

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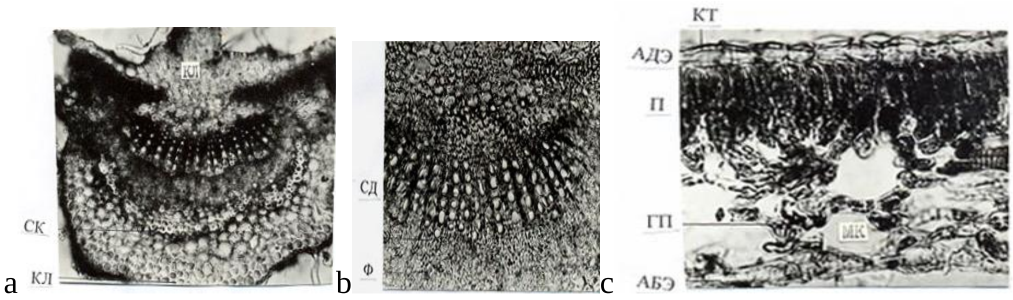

Figure 1. Fragments of cross-sections of an apple-tree leaf in a control area at a magnification of 10x20: a - cross section, b and c - median bundle.

Legend: GP - spongy parenchyma; K - cambium; CL - collenchyma; CT - cuticle; MK - intercellular space; P - palisade parenchyma; SD - vessel; SC - sclerenchyma; E - epidermis; F - phloem; ADE - adaxial epidermis (upper); ABE - abaxial epidermis (lower)

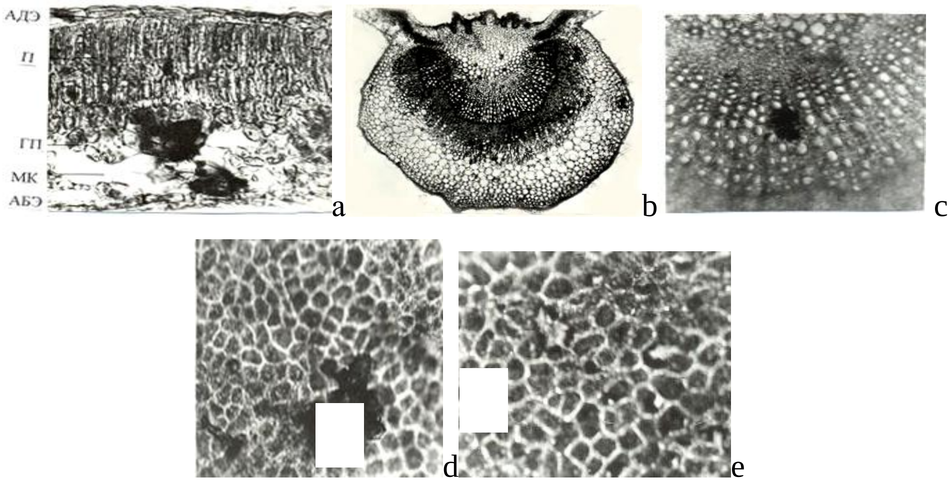

Figure 2 Fragments of cross-sections of an apple-tree leaf on the experimental plot at a magnification of 10x20. Contamination of the spongy parenchyma of mesophyll (a); contamination of the conducting system of the median beam (b, c); contamination and rupture of abaxial epidermal cells (d, e).

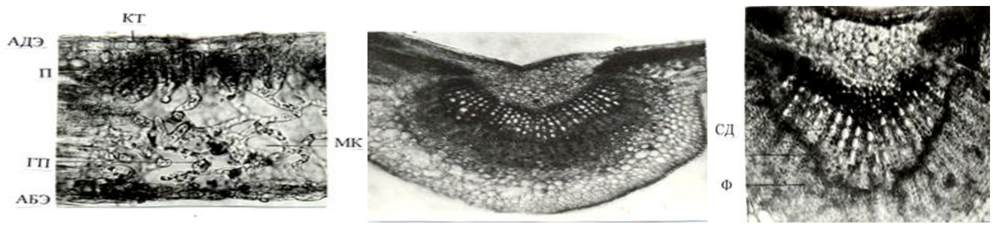

Figure 3. Fragments of transverse sections of a quince leaf in the control area at a magnification of 10x20: a - transverse section, b and c - median bundle

Figure 3, a, b shows black spots that pass through the abaxial epidermis to the spongyparenchyma, and then to the upper layer of the mesophyll, which, apparently, can be associated with the mechanism of the effect of pollutants on cellular structures.

At the same time, breaks of different diameters are also observed in the epidermis (see Fig, e), a decrease in the number of stomata per 1 mm2, loosening of the spongy parenchyma, an increase in the ratio of the thickness of the palisade parenchyma to the spongy parenchyma (hn / hg), and the number of vessels on the medial vein of the leaf. These violations were noted to a large extent in experimental apple plants (see Fig. 4,).

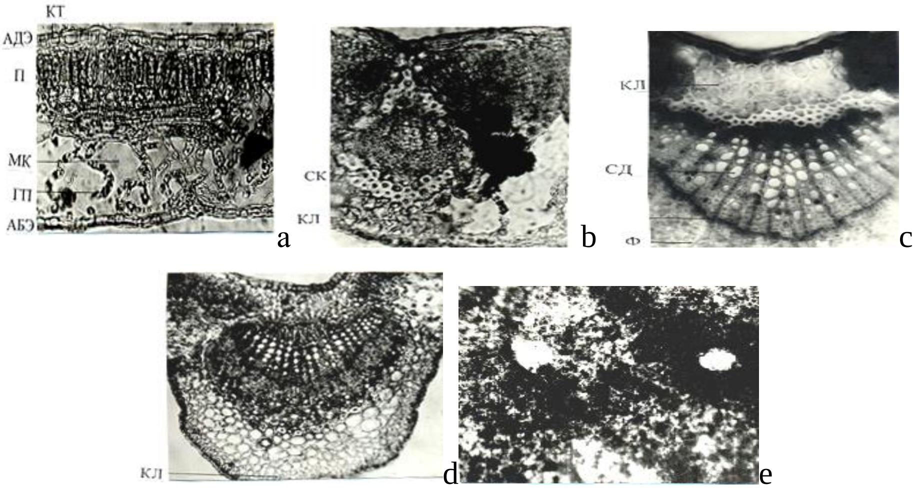

Figure 4 Fragments of cross-sections of a quince leaf on a test plot at a magnification of 10x20. Contamination of the spongy parenchyma of mesophyll (a); contamination of the conducting system of the median beam (b, c); contamination and rupture of abaxial epidermal cells (d, e)

Research results show that air pollution, soil pollution, dustiness, etc. act on local areas of leaf mesophyll. The characteristic symptoms of damage are the destruction of cells of the epidermis and spongy parenchyma of the mesophyll, a decrease in the number of stomata by 1 mm2. In conditions of severe pollution, the xerophilization feature intensifies: thickening of the cuticle, an increase in the height of the adaxial epidermis, palisade cells, the number of vessels on the medial vein, thickening of the mesophyll, sclerification of the veins.

Comparative anatomical study of quince and apple leaves in control and under conditions of urban pollution revealed certain differences. In experimental apple plants in the epidermis, breaks of various diameters, a decrease in the number of stomata by 1 mm2, loosening of the spongy parenchyma, an increase in the ratio of the thickness of the palisade parenchyma to the spongy parenchyma (hn \ hg), and the number of vessels on the medial vein of the leaf are observed (Fig. 1). That the components of the complex pollution of the natural environment act on the local areas of the leaf mesophyll. In conditions of severe pollution, there is an increase in the signs of xerophilization: thickening of the cuticle, an increase in the height of the adaxial epidermis, palisade cells, the number of vessels on the medial vein, thickening of the mesophyll, sclerification of veins. Cherry and quince are relatively resistant to exhaust gases, walnut occupies an intermediate position, and apple and apricot are relatively sensitive.

Recommendations for the rational cultivation of fruit trees in urban ecosystems boil down to the fact that fruit trees should be grown away from highways behind protective plantations of tree and shrub species that provide intensive air exchange, dispersion and / or absorption of gases, dust and harmful toxicants. A preliminary selection of gas and dust-resistant woody plant species should be carried out, as well as the level of their tolerance to various types and biotopes of urban pollution should be taken into account.

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