

ANATOMO-MORPHOLOGICAL SYMPTOMS CAUSED BY THE INCOMPATIBILITY TO GRAFTING IN THE CASE OF THE PEAR TREE

SIMPOTOME ANATOMO-MORFOLOGICE CAUZATE DE INCOMPATIBILITATEA ALTOIRII LA PĂR

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***Abstract.** The anatomo-morphological observations aimed at identifying the structural modifications on the level of the grafting point of the scion-stock associations that presented the incompatibility phenomenon. We used the varieties Contesa de Paris and Untoasa Bosc grafted on Cydonia oblonga stocks which were incompatible with the studied varieties and Pyrus sativa, a stock compatible with the two varieties. The observations showed the calusogenesis process, the formation of the new cambium elements and the vascular tissues and the recovery degree of the continuity of the vessels. In the case of the incompatible associations, the presence of the histological anomalies determined the appearance of some clear symptoms of localized incompatibility.*

Key words: scion, rootstocks, incompatibility

***Rezumat.** Observațiile anatomo-morfologice au urmărit identificarea modificărilor structurale la nivelul punctului de altoire al asociațiilor altoi-portaltoi la care s-a manifestat fenomenul de incompatibilitate. S-au folosit soiurile Contesa de Paris și Untoasă Bosc altoite pe portaltoi Cydonia oblonga, portaltoi incompatibil cu soiurile studiate și Pyrus sativa, portaltoi compatibil cu cele două soiuri. Observațiile efectuate au evidențiat procesul de calusogeneză, formarea noilor elemente de cambiu, a țesuturilor vasculare și gradul de refacere al continuității vaselor. În cazul asociațiilor incompatibile prezența anomaliilor histologice determină apariția unor simptome certe de incompatibilitate localizată.*

Cuvinte cheie: altoi, portaltoi, incompatibilitate

INTRODUCTION

The incompatibility to grafting is one of the most important issues that the fruit growing practice must deal with. The mechanism of the incompatibility to grafting is considered to be a result of the mutual influence between scion and rootstock.

The approach of the researches on this phenomenon must start from the knowledge of the mechanism of the interaction between scion and rootstock. These researches refer to the cytological and biochemical responses in an incipient stage in the grafting process, as well as to the consequences of these events regarding the future of the evolution of the partners.

In the case of the ligneous plants, the main reason of the incompatibility is considered to be the inability of the symbionts to establish new vascular

connections as well as the small differentiation when the connections are established (Errea and colab., 1994).

In these cases, an abnormal differentiation process of the neocambium leads to a cambial involution and a lack of differentiation of the new vascular elements, as shown in the case of the grafting of the pear tree on the quince tree (Ermel et al., 1999) and of the apricot tree on *Prunus* rootstock (Errea and colab., 1994). Nevertheless, incompatible symbionts can grow for many years without showing external incompatibility symptoms which indicates the presence of the vascular connections in the case of the incompatible combinations (Hartmann and colab., 1997).

The researches aimed at identifying the structural modifications on the level of the grafting point of the scion-stock associations that presented the incompatibility phenomenon.

MATERIAL AND METHOD

The experiment was conducted on the experimental field from "Ion Ionescu de la Brad" Agricultural Sciences and Veterinary Medicine University, Iasi from „Vasile Adamachi" S.D.E.

The used biological material originated in the collection of the Faculty of Horticulture, represented by two varieties of pear tree (Untoasă Bosc and Contesa de Paris) grafted on the rootstocks *Pyrus sativa* and *Cydonia oblonga*.

The observations were done during the vegetation period, the planting material being in the first vegetation year. In order to make the histo-anatomical observations, the vegetal material was fixed in ethanol 70%, sectioned under the semiautomatic microtome, colored with methylene blue and ruthenium red.

The assembling of the sections was done in Canada balm and the observations were made with the optical microscope Motic, using the eyepiece 10 and the lens 4.

RESULTS AND DISCUSSIONS

The phenomenon of the incompatibility to grafting determines the failure to reconstruct a system of vascular tissues that is continuous, functional and resistant to the mechanical action.

From the anatomical point of view, the incompatibility phenomenon determines an imperfect recovery of the leading tissues in the grafting area by replacing them with incompletely lignified radial tissue that has discontinuities of the cambium and the vascular tissues which leads to an increase of the vulnerability of the tree to the mechanical action.

The microscopic observations made on the transversal sections through the grafting point have shown the presence of the callus and the non-differentiated parenchymatic tissue.

Both in the case of the compatible variant (fig 1, fig 2) and in the case of the incompatible one (fig 3, fig 4) the callus is formed on the wounded surfaces of the two symbionts, filling the empty spaces between the scion and the rootstock.

Non-differentiated parenchymatic tissue

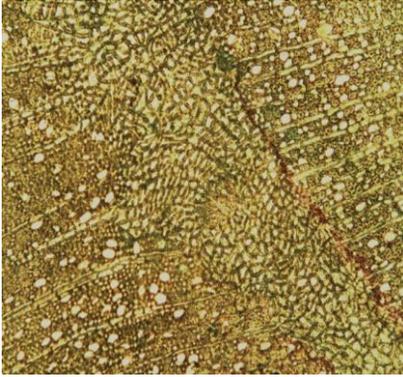


Fig. 1. Contesa de Paris/*Pyrus sativa*

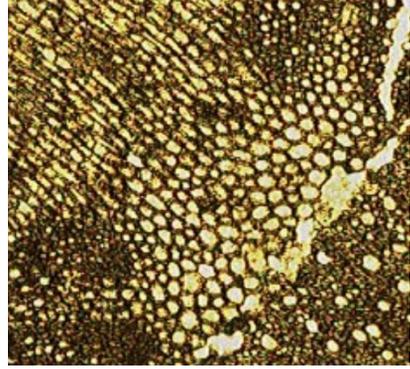


Fig. 2. Contesa de Paris/*Cydonia oblonga*

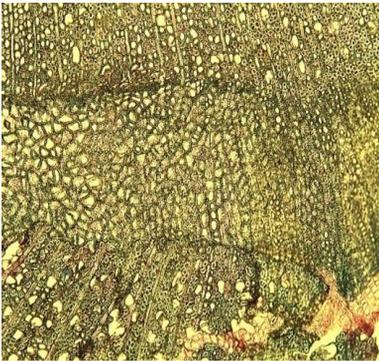


Fig. 3. Contesa de Paris/*Pyrus sativa*

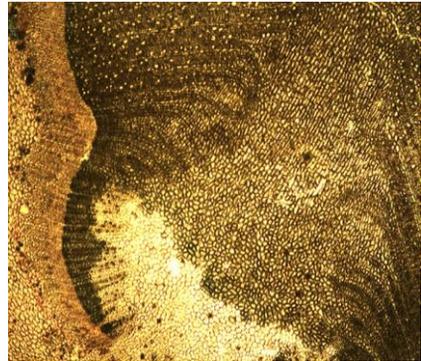


Fig. 4. Contesa de Paris/*Cydonia oblonga*

In the case of the compatible combinations (*Contesa de Paris/Pyrus sativa*, *Untoasă Bosc/Pyrus sativa*) the meristematic cells generate new leading tissues: Liberian vessels towards the exterior and wooden beams towards the interior. Once the leading tissues are formed, the two partners can be called symbionts (fig 5, fig 6). The forming of the vascular connections is considered by most of the authors the basic requirement for a successful grafting.

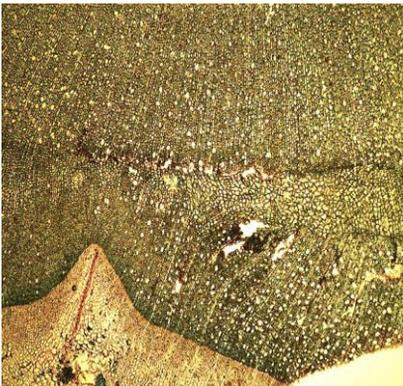


Fig. 5. Contesa de Paris/*Pyrus sativa*

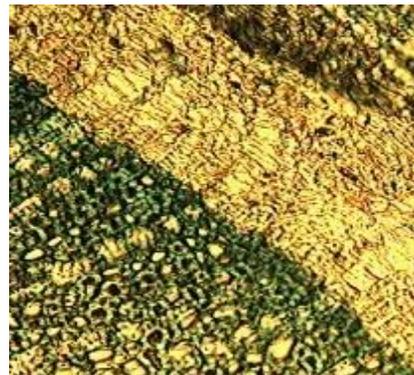


Fig.6. Untoasă Bosc/*Pyrus sativa*

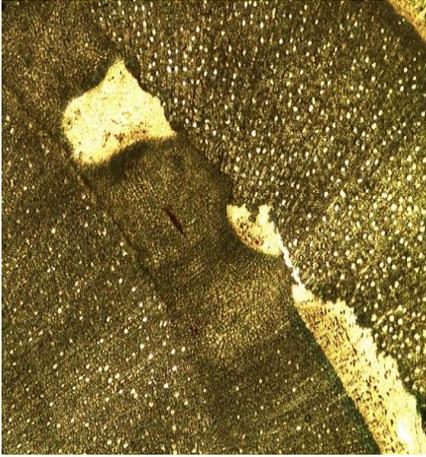


Fig. 7. Contesa de Paris/*Cydonia oblonga*



Fig. 8. Untoasă Bosc/*Cydonia oblonga*

In time, the incompatible combinations (Contesa de Paris/*Cydonia oblonga*, Untoasă Bosc/*Cydonia oblonga*) manifest a low affinity degree.

In the same places, the callus has not differentiated itself in the cambium and the vascular tissue which leads to extended areas of non-differentiated callus cells on the level of the grafting point. (fig. 7, fig. 8).

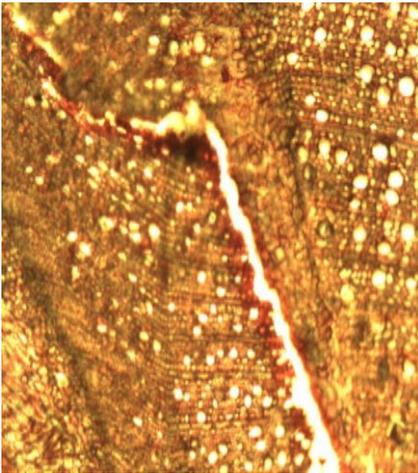


Fig.9. Untoasă Bosc/*Cydonia oblonga*

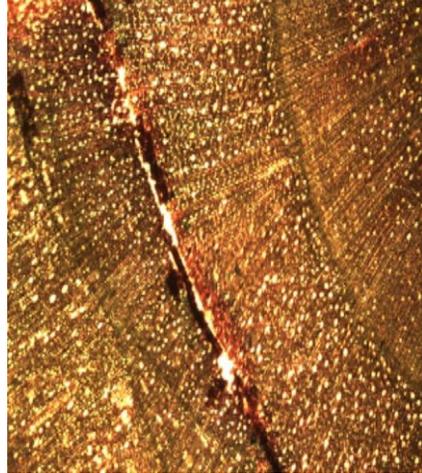


Fig.10. Contesa de Paris/*Cydonia oblonga*

During the growth and the development of the tree, the lack of the cambial activity in some areas of the grafting point affects the integrity of the newly formed xylem and floem, as a result of the discontinuity of the cambium and the forming of a strip of non-differentiated parenchymatic cells (fig. 9, fig. 10).

The presence of this strip of non-differentiated parenchymatic cells, between the two partners, interrupts the vascular connection, determining a weak

joining between them and the reduction of the circulation of the sap through the grafting point, shortly generating incompatibility symptoms.

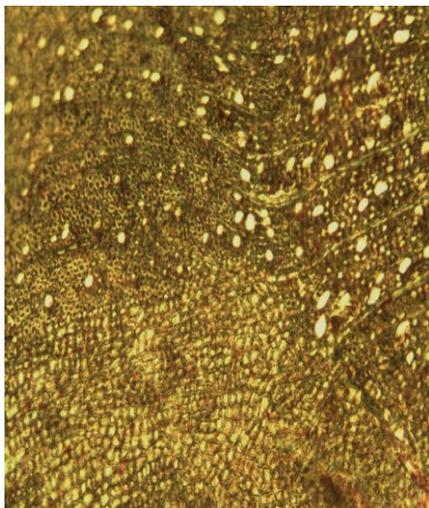


Fig. 11. Contesa de Paris/*Pyrus sativa*

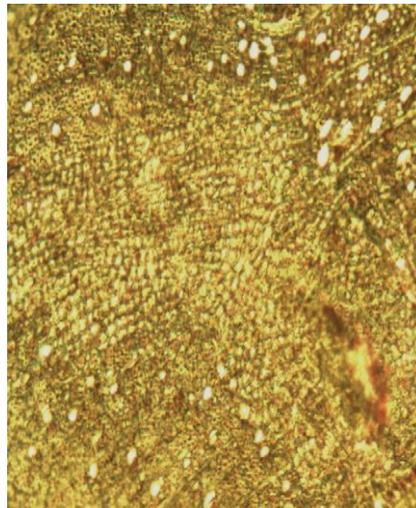


Fig.12. Untoasă Bosc/*Pyrus sativa*

Regarding the compatible variant (fig.11, fig. 12), where the joining and the vascularization have already been done, we can notice a continuity between the cambial tissue of the rootstock and that of the scion.

Following the activity of the meristematic tissue, new leading tissues resulted (lignous and liberian), thus providing both the water and the mineral supply to the scion, as well as the best transport of the photoassimilates to the rootstock.

The perfect joining and vascularization on the grafting point shows the existence of the compatibility between the two symbionts.

CONCLUSIONS

1. The microscopic observations made on the transversal sections through the grafting point show an initial normal development of the callus both in the case of the compatible variant and in the case of the incompatible one.

2. In the case of the compatible variant, it can be noticed a complete recovery of the leading vessels of the two partners which reflects a normal activity of the physiological and biochemical processes of the tree.

3. In the case of the incompatible variant, even though initially the joining on the level of the grafting point is good, the recovery of the vascular tissues is not perfect. In some areas, we can notice non-differentiated parenchymatic cells in the leading vessels of the scion and of the rootstock which renders difficult the circulation of the sap between the two partners.

4. From the anatomical point of view, the two incompatible combinations have not shown serious incompatibility symptoms during the first year after

grafting but, nevertheless, the growth and the development of the trees is not satisfying.

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