The study of the fitosanitary status influence on the biological decline of the plum trees, in Regin area

(SUMMARY OF Ph.D. THESIS)

PhD student  Valentin Berekmeri

Scientific coordinator  Prof.univ. dr. Carmen Puia
1. The current stage of the research concerning the disease of the plum tree

The parasitic diseases that cause damage in the plum tree plantations are represented by virosis, bacteriosis and mycosis. Also, the biological decline of the plum tree caused by xylophagous fungus has developed alarmingly in the plum tree plantations worldwide.

2. The biological decline of the trees.

The etiology and the importance of the biological decline

The decline or the degradation of the trees starts depending on the nutrition of the starting agent, dead or alive alburnum and it always spreads in the duramen because the fungus that destroys the wood prefers this section.

These fungi are characterized by the fact that they affect the trees in the long term of many years leading to the gradual decrease of the vitality and health of the trees that is their decline.

The pathogenic factor involved in the biological decline of the fruit trees are represented by Ganoderma sp. Hypoxylon deustum, Phellinus sp., Schizophyllum commune, Laetiporus species, Armillaria sp., Trametes versicolor.

The causes of the appearance of the decline

The biological decline is a complex phenomenon favoured by, firstly, the wounds and injuries that appear on the bark and fruit trees. The factors that cause problems include biotic, abiotic and human factors.

The biotic factors are represented by viruses, bacteria that cause injuries to the bark, stems and branches. The insects can cause injuries through their actions on their tissues and branches. The xylophagous fungi can depreciate the wood inducing discoloration and deep degradation.

The abiotic factors: the humidity and temperature are two of the most important climatic factors that regulate the development of the fungi, the start of the decline and the rate of the decline of the trees.

The antropic factor that influence the start of the biological decline in the plum tree plantations and not only in this are shown by the improper usage of the agricultural machines that can damage the fruit trees, annual altering of the trees, but also the grazing in the fruit tree plantations.

The xylophagous pathogens involved in the biological decline

The species of the pathogens frequently common at the declining trees that provoke the drying in branches, the dote and the cancers are part of the genus Nectria, Cytospora, Diplodia, Fomes, Polyporus, Ganoderma, Stereum, Schizophyllum etc.

Controlling methods of the biological decline in the plum tree

The control of the biological decline is achieved traditionally through growing methods that prevent the stress conditions and assures the strength of rapid healing of the wounds. There are also some systemic fungicides that are used to protect the
plantations against the xylophagous fungi. Lately, the biological control of the implied fungi in the biological control of the plantation has got bigger proportions.

**The process of the forming of the callus**

The process is very complex. The callus is a tissue composed by stem cells apparently disorganised which appear as a response to an injury, from the tree. The process when the callus is forming is an efficient method of the tree to prevent the infection as well as the loss of water. Thee callus derives from different types of cells having the ability to regulate organisms or tissues suggesting their multifunctional capability.

**3. The objectives of the paper**

The PhD paper has the following aims: observation of the reaction of the biological defence mechanisms of the plum tree, keeping the integrity towards the factors which tend to unbalance physiologically the internal functions and to produce the start of the biological decline, monitoring the phytosanitary conditions of the plum tree plantations, observing the reaction of the lant from the fitopatological and physiological point of view after being treated on the bark using different substances both conventional and unconventional, efficiently isolation of the wound on the tree, pursuing the mechanism of the callus and the infection with xylophagous fungi in the plum tree plantations, establishing the importance of the abusive cuttings together with the infection of the xylophagous fungi in the launch of the physiological decline of the plum tree plantations.

**4. The natural conditions of the experimental area**

The experimental area was situated close to Reghin city, Mures district. The field where the trees are situated has the dimensions: 1.15 ha and it is situated 4 km west to Reghin via Cluj.

**5. Material and methods**

**The biological material**

The biological material used was consisted of 4 varieties of plum trees (*Prunus domestica*) and for instance de Bistrița, Stanley, Anna Spath și Silvia.

**The substances used in the experiment with conventional and unconventional treatments**

The substances used in the experiment with conventional and unconventional treatments were slaked lime, piatra vânăță, Bordeaux mixture, Dithane DGD NEO-TEC, Previcur Energy, Aliette 80 WG, rivanol, sodium bicarbonate, Brewer’s yeast.

The isolation substance for the injuries on the bark is a substance whose mixture is formed by 3 litres of oil, 2 kg of calcium hydroxide powder and 200 g NaHCO₃.

**Research methods**

**The experimental protocol for the study of the effect of the conventional and unconventional treatments of the callus**

The experiments organised are based on 3 factors as followed: A – year with a1, a2, a3, B – the varieties b1, b2, C - phytosanitary treatments with c1-c10.
**Monitoring the phytsanitary state**

Monitoring the phytsanitary state of the plum tree plantations took place in 2012, in July, on a surface of 25 ha, in different forms of exploitation. After having observed the virotic, red spot and leaf perforation symptoms, observations have been made concerning the frequency, intensity and attack degree of the studied pathogens in the plantations.

**Monitoring the callused injuries**

Besides the below observations, two experiments followed the injuries on the varieties taken into study and the effect of the callus formation on xylophagous fungi.

In 2011, it was achieved the isolation of the injuries in the plantations, caused mainly by the abusive cuttings, most of which presented infections with xylophagous fungi from the *Phellinus* genus.

On the clen branches of the tree the measurements were done using milimeters. In order to analyse the reaction of the pH of the bark in 2014, from 2 plantations, with industrial exploitation and minimum number of treatments, bark samples were taken to determine the pH influence in the fungus life and development.

**Results and discussions**

**The results concerning the conventional and unconventional treatment on the callus formation**

In 2011, the most efficient treatment applied to the Bistrița variety was that lime water which, statistically speaking this variant registered major differences compared to the control. On the other hand, the least efficient treatment was observed at the V9 variant, the clay variant, where the surface of the callus was 0,77 mm, statistically assured by the negatively significant differences compared to the average of the experiment.

The Stanley variety presents a different situation because the majority of the used treatments did not register statistically assured differences towards the control, except for the Dithane treatment, were significant negative differences were observed.

In 2013, for the Bistrița variety the most efficient treatment was Dithane, while the clay and yeast, unconventional treatment were the least efficient treatment variants.

Forr the Stanley variety, the most efficient treatments were those made with dithane and Previcur, while the lowest efficency was observed at the variants with clay and yeast.

Taking into consideration the three years, in comparison, we could observe that the variants treated with lime water, copper oxide, Dithane and Aliette were the only variants that had registered statistically assured differences.

**Results regarding the phytosanitary sttus of the monitoring in Reghin area**

**Monitoring the main diseases**

The main foliag symptoms that were noticed were the virus ones, the red spot and bacterial perforation and the main xylophagous fungi idenified was *Phellinus igniarius*. 
Taking into consideration the frequency of the virotic symptoms in the plantations, it can be noticed which variety was the most sensible under the attack of the viruses.

The frequency of these symptoms in the plantations were Bistrița 97,27%, Stanley 84,11%, Anna Spăth 42,57 and Silvia 11,24%.

The attack degree of the red spot symptoms recorded values from 0,07% in the case of Silvia variety to 4,16% in the case of de Bistrița variety. The differences between the varieties are also sustained by the Duncan test.

The attack degree calculated for the leaf perforation caused by Pseudomonas and Xanthomonas was measured between 0,50% for Silvia 0,57 % for Stanley and 1,08% for de Bistrița.

**Monitoring the injuries from the bark**

The results for the monitoring of the fruit trees with or without injuries, or with or without infection, with or without callus are as follows:

After the analysis of the results, the Anna Spăth variety showed the lowest percentage of injuries while the highest level of fruit trees whit injuries was resented by Stanley variety, folowed by de Bistrița and Silvia.

After the analysis of the data obtained by monitoring the fruit trees concerning the presence or absence of the infection on the injury it can be drawn the conclusion that the Silvia variety had the highest percentage of the injuries infected with Phellinus, folowed by Stanley variety.

To conclude, the infections of the injuries because of the xylophagous fungi are an important factor in blocking the callus or in disturbing the mecanisms that work to renew the tissuses of the injured reas.

**Results concerning the isolation of the injuries**

As the trees with no isolated injuries are concerned, the infection caused by Phellinus, in 2012, had a value of 83,33% for Bitrița and 91,66% for Stanley. All the tree samples had presented infected injuries in proportion of 100%.

After one year from the isolation, there were grown formations of Phellinus xylophagous fungi.

In September 2014 the following results were recorded: the Bistrița variety had 21,81% of trees that displayed fungi formations of phellinus an 22,2% of trees displayed callus on the injured areas.

The Stanley type had 31,97% of the trees that recorded Phellinus fungi formations and 0,8% of trees had callus on lesions.

**Conclusions and recomendations**

**7.1 Conclusions on the conventional and unconventional treatments**

As the efficacy of the different variants of treatment on the callus lesions is concerned, we can state that the variant of dithane was distinctly superior to those of Previcur, copper sulphate.

**7.2 Conclusions on the monitoring of plantations**
After having monitored the plum tree plantations in Reghin area, we could observe that the foliage diseases from the industrially plantations where leaf treatment were applied had a 0% frequency.

The experimental year 2012 was a very dry year which was not benefic for the leaf diseases.

**7.3 Conclusions on the monitoring of lesions**

In every monitored plantation we could notice the presence of the injuries on the bark, stem and main branches of the trees.

The majority of the injuries did not present infections with xylophagous fungi and the callus was stronger developed.

**7.4 Conclusions on xilophagous fungi infections**

The *Phellinus* xilophagous fungi infection were noticed in all four monitored plantations. The *Stereum* infection was seen only in the industrially worked plantation.

**7.5. Conclusion on the callus formation**

Taking into account the differences in the callus process observed on the lesions, we can affirm the fact that the percentage of the callus formation was higher on Stanley variety compared with de Bistrița.

**8 The originality and the innovative contributions of the thesis**

Describing the infection process of the xylophagous fungi in the plum trees plantations around Reghin area, we draw the attention on the presence and the negative role of the physiological decline of the trees.

The use of conventional and unconventional treatments on the bark in order to test the effectiveness against the xylophagous fungi infection and to help the process of the callus formation represents an element of uniqueness.