NEW WAYS OF COMBATING CHESTNUT BLIGHT CANKER

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IN ALBANIA

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INTRODUCTION

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The chesnut canker is a fungal disease which damages chestnut and oak trees. It affects the plant air system, except for the leaves. Sometimes the fungal mycelium is found even in the trunk of chestnut tree, but it mainly affects and damages the outer bark. It may also affect the roots, if they are exposed to the air. The infection or the parasite infection occurs through wounds in the outer bark layer of chestnut trees. The first symptoms appear about two weeks after the parasite penetrates the wound. The life of the parasite on the chestnut tree is not influenced by weather conditions.

The innovative idea has to do with the way of fighting canker in the outer bark of chestnuts trees (Endothia parasitica Mur.) through the mechanical method of using mud /soil and copper sulphate (CuSO4). The implementation of the Project on Combating canker in chestnut barks using the Mud (Soil) Method started on 10.06.2011 and was completed on 10.09.2011. The study of the area and of chestnut plantations as well as the identification of specimens that were affected by the blight canker on bark trees, which was followed by drying of trees and reduction of productivity, played an important role on the successful implementation of this project. Afterwards, the preparation of the mud/soil method which would be applied to fight canker in the chestnuts barks as well as the preparation of materials that would be used in the implementation of this method, was of special importance. This had to be explained to the farmers, so that they could replicate it in their plantations, to preserve and enhance the production capacity of natural chestnut plantations. The identification of the chestnuts affected by the blight canker disease in the commune of Kastriot and prevention of this infectious disease had to be done.

The impact of the innovation developed can be resumed in the following points:

- The community is aware of the need to improve the situation of chestnut plantations;
- The farmers are aware of the importance of prevention on the production growth and information is shared with the community;
- The necessity of grouping farmers in chestnut growers associations following the project training.

About 70 families with a population of 350 people are now interested in improving the condition of chestnut trees already affected by blight canker.

The method of fighting blight canker in chestnut trees barks with mud and copper sulphate was a new finding, which has emerged as a result of individual efforts to prevent the blight canker from chestnut trees barks and to treat and heal it. What makes this innovation valuable is the way of application in chestnut trees, where the impact was immediate. It was observed how the affected chestnut trees barks were isolated through this method. Indeed, the improvement observed after the intervention means the intervention was successful because there was not any degradation or drying of trunks on which this method was applied, and their production has begun to grow.

The institutions involved in this innovation are Albanian Local Capacity Development Foundation (ALCDF), which is the main supporter of the project, the Association of Forests and Pastures Users of Kastriot Commune, which was interested in this kind of service requested to the Foundation, and the Communal Federation of Forests and Pastures of the Diber region, which was contracted to provide this kind of service, since they had the proper knowledge and experience in studding, preparing and implementing this method.

WHAT PROBLEM DOES IT SOLVE

The fungus mycelium is developed in the vascular cambium. It affects initially the tissue of the outermost layer and looks like a white mass in the outside part and yellow in the center. Consequently, when the infection increases, the parasite penetrates deeper into the outermost layer, onto the first layer of the trunk.

At this stage the parasite has a pale color and it takes the frequent characteristic form. This is the best way to detect the presence of the canker and one of the features that distinguishes or separates it from other forms of fungi saprophytes. If the parasite appears in the twigs and sprouts of chestnuts, it looks like a spot with a rusty pink or pale color and with irregular borders, a pimply-looking bump, under which a dense mass can be observed, such as soil (or wool) of a yellow cream color. This is the mycelium of the parasite that develops in the tissue of the outer bark, increasing the cambium. Tissues affected by the parasite have a dark spot, which expands continually until it covers the whole affected body. Frequently, the only sign of the canker will be orange-colored longitudinal cracks in the bark, tending to separate into parts. The name ‘blight canker” is because of the bulges caused by the parasite infection. The infected area of the outer bark can easily be divided (seceded) and the mycelium of yellow cream color can be seen in its inner part. A large number of orange - yellow color epidermises can be seen on the outermost layer. The canker spot increases (grows), cracks and expands into all directions,

surrounding the entire affected stem. The part situated above the cankerous wound will soon get dry, and numerous sprouts (shoots) will begin to emerge out of the wound, surrounding the entire stem.

Chestnut blight canker can be most easily seen on the bark of the juvenile trees when the bark is wet, i.e. during the warm and wet seasons of spring and autumn. The parasite has the shape of red orange spot. If the spots (rushes) have round shape and can be easily noticed, we have to do with piknides (not the perfect form of fungi) from which piknokonide comes, mainly when the air humidity is high. If the rashes have pimply-looking bumps they are peritece, which develop in rusty red color stromata of 1.5-2 mm diameter. The peritece appear mainly in autumn and produce(s) askospores for two seasons. They have the form of a small round bottle, black membrane walls, which contain a large number of protracted askus. Each askus contains 8 askospores. When the askus mature they release and throw askospores some centimeters away. The parasite is spread around by the wind, which transports askospores to long distances. The parasites are also spread by conidia, but not by the wind. The conidia are collected in a sticky substance. This amount melts because of the rain and flows throughout the plant. The conidia transmits (spreads) the infection into the other parts of the stem, and it is also deposited in the ground. It is from here (from the stem or ground) that insects, birds and falling rain spread the disease (the parasite). The sensitivity from the parasite is different depending on the age, species and cultivar. So, for example, juvenile chestnuts resist better to the canker infection, thus the amount of conidia transmits (spreads) the infection into other parts of the tree, and deposits it into the ground. From here, i.e. from the tree or ground the insects, birds and falling rains can spread the disease (the parasite). The sensitivity to the parasite is different according to age, species and cultivar.

Juvenile chestnuts resist better to the canker infection, so the coppice overpasses the disease generally by having again new strong offshoots, while in the chestnut grove for fruit the infection causes the drying of affected plants. The disease is more serious in the Castanea dentate chestnuts, and less in sativa chestnuts. Castanea and Castanea mollisime are more sustainable.

Methods of chestnut canker combat

There are three methods used to fight canker in chestnut bark: physic-mechanical, chemical and biological.

The physic-mechanical method

The physic-mechanical method aims at healing and preventing. For this purpose, every year or every three years during the growing period (June-August), when infected trees can easily be distinguished, the phytosanitary control should be made to identify affected trees and the level of infection. After the control, all affected twigs and branches should be cut to prevent the development and spreading of piknids. The cut is made 50 cm below the infected area. When the parasite has not infected the entire stem, only the diseased part should be removed, the healthy part should not be touched. All tools used for cutting should be disinfected with sodium hypochlorite or ethyl alcohol. After the cut, the material is carefully collected and burned. Each wound after cutting is brush-painted with 3% bordolez liquid. When the entire stem is infected, the chestnut trunk is cut at the ground level and if the first offshoots are affected, 2-3 cuttings are made in order to have sustainable offshoots emerge. A preventing measure is to cut and paint the wound with 3% bordolez liquid, and spray the tree with 1% bordolez liquid. This prevents infections coming from the bark, caused during cutting, otherwise, it will remain a pathway for the penetration of the parasite into the tree.

The chemical method

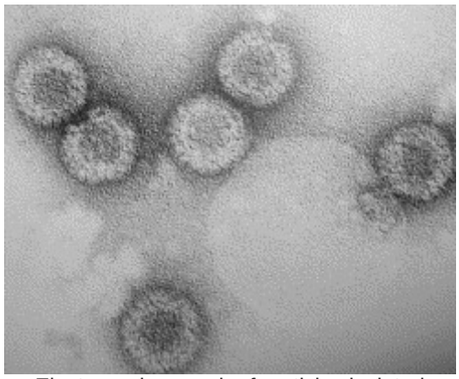
The chemical method consists of spraying or painting the wounds or the entire stem with different fungicides. To this purpose are used: bordolez liquid, copper oxychloride, zineb, dodene, enovit, thiophanate methyl, captafol, thiuram mix, maneb, ziram, carbondenzin etc. The results have been various, in compliance with the stages of the disease. So, if applied at the beginning of the infection the results of the chemical method are higher, if applied at advanced stages of the disease the results are lower.

The biological method

The biological method is applied in three ways: through infected soil with microorganisms, by grafting, using immune species and by inoculation (strain) using a hypo virulent. The Biological War through packing the ground leaves aside the method of hypo virulent strain. This method has given good results to the C. dentata chestnut. It is believed that the earth stops (Isoniazid) growth of the canker caused by the parasite Endothia parasitica. Based on this feature, the healing of infected chestnut bark from the canker by taking soil around the trunk of the tree has been achieved. To this purpose, soil was taken at the vicinity of the infected chestnut tree, which was mixed with water until it became watery, then a plastic material was

wrapped around the canker, making sure the plastic is fixed by adhesive tape or by any other material beyond the top and bottom edges of the canker. Then the wet soil is put in a plastic material, which is well fixed. The canker wound should be completely covered with a 2-3 cm thickness. It is left so about 2 months or during the whole growing period. Thus, soil contaminated with microorganisms destroys existing canker, but it does not protect plants from any other new infections. Healing chestnut bark canker happens due to fungus trichoderma, which first impedes development of the cankerous fungi, then kills it (Endothia parasitica). So the agent acting in the plastic material with wet soil is a type of Trichoderma viride, which is part of the fungal flora of the soil around the chestnut tree. In recent years in Italy the biological method has been used to fight or prevent the canker parasite in grafted chestnuts.

At first, chestnuts immune to the disease, with good fruit and previously tested in vitro if they are vulnerable to canker or not, are selected; then they are grafted. Grafting usually is applied by cutting the bark and the crown and introducing a leaf bud. Grafting is made in spring (April-May) in days with a temperature of 15-20% C, in high atmospheric humidity and with no high winds. The cuts should be disinfected with copper oxychloride dissolved in linseed oil or Benomyl 20-40 g. dissolved in a little water and mixed with one kg. of vinavil. This mixture is brushed on the tree. In the recent years the mud prepared as above has been applied on the graft and underneath it as a preventing measure. This parasite of this fungus nowadays appears in two forms: virulent or active (developing) on the plant and the other hypervirulent or inactive. Both forms of canker are distinguished morphologically and especially physiologically. The virulent strains cause virulent or typical canker, which can cause drying of one part of the tree (affected location) or of the entire tree. The hypervirulent strains are inactive or atypical cankers, which are found less in plants. The hypervirulent strain derives from virulent (active) strain. It has a characteristic ability: it is able to transform the virulent strain (active) into unvirulent through the combination of hyphae of two strains in contact with each other (operative with inoperative).



Electron micrograph of particles isolated from ***C.*** *parasitica* strain 9B21 (Kondo, Hillman, and Suzuki, 2002, unpublished data).

So the healing ability of hypervirulent strain while penetrating the virulent canker is associated with the transmission of anastomoses (intervention of hyphae), one of the cytoplasmic factors with viral origin used for biological intervention, thus enabling healing of the affected plants. In southern France inoculation of a large number of chestnuts was conducted. In three years 50% of the wounds were healed and in five years 70%. Ten years after inoculation in the forests, no chestnut blight canker was detected. The transmission of hypervirulence is associated with the creation of hyphae anastomoses, since it occurs only in the special condition of harmonization between vegetative virulent and hypo virulent strains. The anastomose is tested when two different cells get in contact; they are placed one next to the other, they melt into one cell allowing the connection of cytoplasm, the exchange of nutrient substance or of defining cytoplasm, which makes fungi colony to be appropriate to the environment. After many tests, it is observed that E13 is the most suitable strain for inoculation.

Advantages of the innovative method

The goal of this project was to prepare and implement the method on combating blight canker in chestnut trees barks by wet mud and prepare the materials for transfer of knowledge and train farmers of the area. The project also aimed at identifying the area affected by blight canker in the commune of Kastriot. Farmers of the area were trained on the field on how to use the method of combating chestnut canker using mechanical ways of mixing soil with other materials. The farmers were informed throughout the training that the restoration, preservation and development of the production capacity of natural chestnut forest would be enabled through application of regenerative works in chestnut plantations and protection of land (forest) from erosion or any other atmospheric and biological harming factors, etc. From a scientific viewpoint the aim of the project was to mechanically fight canker using the soil/ mud method applied to the bark of the tree, renew, preserve and enhance the production capacity of the natural chestnut forest, apply regenerative works, protect land (forest) from erosion and other biological damaging factors, etc. with the aim of increasing the potential of natural chestnut fruits production, increasing of employment for beneficiaries and mostly of sustainable income in the area, renew, preserve and enhance the production capacity of the natural chestnut forest.

Through training provided to local farmers by the staff of Forests and Pastures Federation it was managed to:

- Set up a good tradition of cooperation with the beneficiaries of the community;
- Transfer technologies and more efficient ways to cultivators on how to combat blight canker in chestnut trees;
- Raise awareness of farmers on seasonal prevention of blight canker in chestnuts trees plantations;
- Thanks to the transfer of knowledge for preventive and improvement works, the community of Kastriot commune is willing to replicate this experience in other areas and plantations in their possession;
- Encourage the farmers to increase the size of chestnut plantations by raising the farmers' awareness on the value of nuts and increase of chestnuts production income.

What makes this project sustainable is the community interested in improving the situation of chestnut trees. They want to apply new technologies, but they lack information on intervention approaches. An intensive application, associated with fighting the blight canker disease will increase the amount of chestnut production. The sale would be facilitated by the establishment and development of associations on chestnut growth. This project provides new opportunities for improvement of chestnut productivity, and it significantly reduces the risk for trees to be affected by blight canker, causing trees to increase production and not to dry. With the protection of trees from drying caused by blight canker, the community income has increased through chestnut fruit production. It enables protection of trees in the process of drying. This provides environmental protection and ecological improvement. It creates opportunities for the production of large quantities of chestnut fruit supporting communities to trade higher amount in the market, which increases income for inhabitants.

During project implementation no obstacles were noticed which could have hindered the process, since from the very first moment of project introduction to the community, people were interested to learn how to improve and increase the chestnut productivity in their plantations. But, what remains a future challenge in relation to the blight canker in chestnut trees barks, is the prevention of the disease, which must be stopped on time, or the intervention must start from the very beginning of the disease detection to achieve good results, otherwise it would be difficult to protect the chestnut trees and have a successful combating method.

With the implementation of this method to fight bight canker on chestnut trees barks we must say that, in terms of cost, this project and its application method offer new opportunities for the improvement of productivity of chestnut trees, and significantly reduce the cases that affect chestnut trees with blight canker, which brings production growth and elimination of drying. With regard to social aspect, it creates opportunities for the production of large quantities of chestnut fruit, which helps the communities to trade higher amounts of fruit in the market, increasing thus their income.

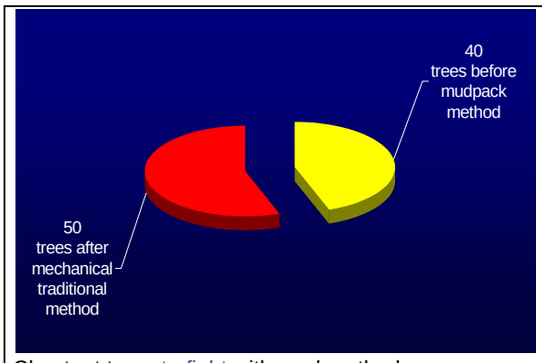
The protection of trees from drying caused by blight canker increases income to the community through chestnut fruit production. But of course, implementation of this method does not require a lot of money. It is sufficient to buy a small amount of plastic material and some copper sulphate or boldolez liquid and mix it with the soil taken on the vicinity of the tree and then apply it on the cleaned parts of the bark. Thus, compared to other methods, this is the simplest and cheapest one, and it can be used to combat the blight canker on chestnut trees barks. Considering the ecological aspect, protection of trees in the process of drying enables protection of environment and ecological improvement. After completion of training and theoretical explanation on application of the method, it has always been concluded that those who really want to be successful and achieve results of their work, should do a practical application in the field where participants and chestnuts users can see themselves how the method of fighting canker in chestnuts barks through the infected soil is easily applicable with a very low cost. To this intent, the method of fighting blight canker through mechanical ways was applied on some trees which has contributed to the income increase of beneficiaries through the utilization of products from regenerated forests. The chestnuts owners and users and members of the association went to the plot identified to be affected by blight canker.

CHESTNUT BLIGHT CANKER IN PRACTICE

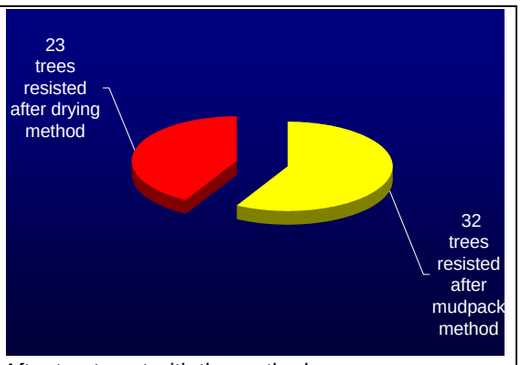
With regard to the method used to combat chestnut canker by mudpack method, it has to do with identifying and cleaning of wood that is affected by the illness. This method differs from other methods because we intervene directly on the wood after the cleaning of the part affected by canker is made. This allows the wood to start the recovery process of the wound caused from canker.

Other traditional methods aimed at cleaning the surrounding territory or felling of infected trees.

But a tree cleaning inhibits the spread of canker to other trees, favoring the drying of wood that is affected by canker. Below are the data related to the number of trees that have improved using the mudpack treatments with clays which has led to drying of the damaged part of chestnut trees.



Chestnut trees to fight with mud method



After treatment with the methods

Practical procedures

The mudpack method has been applied to combat the blight canker mechanically. All that is needed for this treatment is some soil collected under the infected trees, some plastic (a bag, cut open), and some string. Water is added to turn the soil into thick, gooey mud, and this is plastered all over the blight canker. Wrapping the plastic around the trunk or branch keeps the mud damp, and the plastic can be secured with string. It should be kept during the entire period from the beginning of the treatment of the disease to the end of the growing season.

To apply the method, the necessary materials were collected, which would be applied on trees affected by blight canker. The necessary basic materials are: soil, water, copper sulphate (blue stone) which would be mixed, knife, sickle to clean the cankered area, shovel to mix the soil with water.

The work in the field starts with identification of chestnut trees affected by blight canker; the cleaned parts from canker are ready to be filled with the soil and buldozel liquid. The following process is the preparation of convenient material, i.e. mixture of soil and water with buldozel liquid, or copper sulphate. Then the entire affected area is covered with the mixed mud and then wrapped firmly with plastic wrap and completely sealed. The mud must remain on the trunks for a long time so that the canker is isolated and the chestnut tree is well developed.

RESULTS

This project provides new opportunities to improve the productivity of chestnut trees and reduce significantly the blight canker of chestnut trees, which helps increase production and prevent drying. The protection of trees from drying that is caused by blight canker at chestnut bark increases the income for the community through chestnut fruit production. This process offers protection to the trees which are on the process of drying. This also enables protection of environment and ecological improvement of this kind. But this approach creates opportunities for the production of larger quantity of chestnut fruits which enables trade of bigger amount in the market, and increase of income for the inhabitants.

After implementation of this method, all participants were ready to

replicate it on their plantations and on other trees affected by blight canker and they were aware that the implementation of this method was at a very low cost. The implementation of this method increases the beneficiaries' income through the use of regenerated forest products. These interventions in chestnut trees have brought the following great advantages as consequences of results obtained:

- they have created opportunities for beneficiaries to have immediate increased income;
- have increased the demand for application of intervention which has led to employment increase and poverty reduction;
- they have introduced a good tradition on the cooperation among beneficiaries of community, etc.
- they have been transferred to users who apply it on trees affected by this disease.
- they have been taught to the community who are ready to apply them in other plantations on their possession.

they have increased the interest to expand chestnut plantations, due to increased income and value of chestnuts use.

INTERNATIONAL INTEREST

This innovative idea has increased the interest of the community, who, through the implementation of this method in the chestnut plantations and also in other kinds of trees, has enabled improvement of chestnuts condition affected by blight canker, and minimized their drying and reduction of productivity.

The authors of this innovation are able to replicate this method in other countries having the same problems and they want to this method that is applicable by all. Its application needs some information on the improvement and preventive interventions of blight canker in chestnuts trees.

CONTACTS

ALCDF is available to provide technical support and innovation transfer to the interested countries. In order to establish collaborations, contact:

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