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A Research on Chemical Control Against Chestnut Blight (*Cryphonectria parasitica* (Murill) Barr)

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Abstract: This study was conducted with the aim to control the chestnut blight disease (*Cryphonectria parasitica* (Murill) Barr) in a chestnut orchard in 2003-2004. Grafted trees of chestnut genotypes (*Castanea sativa* Mill.) were used as plant material. The chemicals used in this research were; Copper oxychlorite (5%), Benomyl 50 WP (60 g 100^{-1} L water), Carbendaxim 50 WP 50 WP (75 g 100^{-1} L water). The chemicals were applied on 10 and 25 June and 10 July. Six months after the application of chemicals the results were evaluated and the rate of disease (%) and the influence rate of chemicals (%). The highest disease rate was found on the control application and lowest the disease rate is on the Copper oxychloride+Carbendazim combination. The most effective combination was found as Copper oxychloride+Carbendazim and Copper oxychloride+Benomyl combinations.

Key words: *Cryphonectria parasitica,* chestnut, chemical control

INTRODUCTION

Chestnut (*Castanea* Miller) belongs to beech family (*Fagaceae*), and has economic value because of its timber and fruit[1]. It has 13 known species spreaded through the mild temperature zone of the Northern Hemisphere. Five of those species are bred on East Asia, seven on North America and one on Europe[2,3]

Turkey as being one of the gene centers of chestnut (*Castanea sativa* Mill.) takes the third place in the world with its annual production of 50.000 tons after China and South Korea with production of 50.000 tonnes[4,5]. The most important disease of chestnut is chestnut blight (*Cryphonectria parasitica* (Murill) Barr) causes the loss trees of European (*Catanea sativa*) and American (*C. dentata*) chestnut varieties [6-9]. Chestnut blight caused a drop of Turkey's production rate from 90.000 tons in 1990 to 50.000 tons in 2002[4].Pathogen infects the tree at the wound and cracked areas by means of its ascospores from perithecia and conidia from pycnidium. Slight moist weather conditions are suitable for spreading spors. Yellow or orange-brown pycnidial stroma is formed on shell tissue in advanced stages of infection. Conidia of pathogen are rod shaped and colourless. Perithecia of pathogen are formed in stroma in which pycnidia are formed during vegetation. Both picnidia and perithecia can be seen in a stroma at the same time. Perithecial stroma is usually brown. Necrotic and cancer areas are formed on the cambium and shell tissues of piths of stems and branches due to this disease. Debrises can be formed because of the sudden death of shell tissue and cambium due to this disease. If the death is delayed swellings are seen at diseased areas and cracks at shell tissue. Leaves and shoots lose their vitality in the course of time as the water cannot be spread to the piths of these organs. Pathogen can be carried with wind and rain as well as with grafting materials[10]. Chemical control against the disease is applied even the height of the plant restricts the method[11,12].

In this study, various chemicals and combination which were expected to control the disease were tried on the plants in Samsun–Terme province.

MATERIALS AND METHODS

This study was accomplished in chestnut plantation in Terme (Samsun) province in 2003-2004. The basic material of the research is the grafted seedlings which belong to chestnut genotypes selected from Sinop and Samsun provinces[13,14]. The grafted seedlings were planted in 1998 and 1999. The chemicals used in this research were; Copper oxychlorite (5%), Benomyl 50 WP

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Table 1: Application mode of the chemicals

Characters (Application Mode)		
Copper oxychloride	:	(to the infectious area on branch and trunk
Copper oxychloride+Benomyl	:	(to branch and trunk+the leaves)
Copper oxychloride+Carbendazim	:	(to branch and trunk+the leaves)
Benomyl	:	(to the leaves)
Carbendazim	:	(to the leaves)
Control		

(60 g/100 L water), Carbendaxim 50 WP 50 WP (75 g/100 L water). The study was set up according to randomized block design with 6 characters and 3 replications. The chemicals were applied on 10 and 25 June and 10 July (Table 1).

In the application, the infected areas on the branches and trunk were carved down to the health tissue. No chemical was applied on the carved areas for the control. For the applications other than control, Copper oxychloride (5%) was applied on the carved areas by brush, benomyl and carbendazim were applied on the leaves by hand pulverizator (Table 1). Application was repeated 3 times–15 day intervals. Counting and evaluation was performed 6 months later than the final application. Evaluation was based on 0–5 scale considering the size of infected regions. The area of infected regions was calculated by elliptical calculation method[15]

$$S = \frac{a.b}{4}.3,14$$

S: Elliptical blight area,
a: Length of elliptical blight and
b: Width of elliptical blight

The 0-5 scale was formed as follows;

0: No blight formation on branches and/or trunk
1: 1-5 cm^2 lesion on branches and/or trunk
2: 6-10 cm^2 lesion with cracks on branches and/or trunk
3: 11-20 cm^2 lesion with cracks on branches and/or trunk
4: 21-30 cm^2 lesion with small number of perithecium and cracks on branches and/or trunk
5: Lesion greater than 30 cm^2 in area with denser number of perithecium and cracks and/or dry up

The rate of disease was calculated by using Towsend-Heuberger formula on these scale valves:

$$D\% = \frac{\sum (n.V)}{Z.N}.100$$

D: The rate of disease,
n: Number of plants,
V: Scale value,
Z: Maximum scale value and;
N: Total number of plants

The influence rate of chemicals was calculated by using the disease rate results and Abbot formula:

$$I\% = \frac{Dcon - Dch}{Dcon}.100$$

I%: Influence rate of chemical,
Dcon: Disease rate on Control,
Dch: Disease rate on chemical application.

Angle transformation (arc Sin) transformation is applied to the calculated average rate values to realize the differences between the groups[16]. The lettering in the tables was done per transformed figures. MSTAT-C program was utilized in the evaluation of data. "Duncan Multiple Range Test" in MSTAT-C program was used to find out the real important differences between the average valves and to mark the different ones with different letter.

RESULTS

Six months after the application of chemicals the results were evaluated and the rate of disease (%) and the influence rate of chemicals (%) are given in Table 2 and 3, respectively.

Research proves that the rate of disease shows considerable difference depending on the pattern of the application of chemicals. The highest disease rate was found on the control application and the lowest the disease rate is on the Copper oxychloride+Carbendazim combination (Table 2).

Table 2: Rate of disease (%) corresponding to chemical application

Characters (Application Mode)		Average rate of disease (%)
Copper oxychloride	(to the infectious area on branch and trunk	33.39b
Benomyl	(to the leaves) (to leaves)	32.62b
Carbendazim	(to leaves)	32.84b
Copper oxychloride+Benomyl	(to branch and trunk +the leaves)	29.14bc
Copper oxychloride+Carbendazim	(to branch and trunk +the leaves)	27.62c
Control		53.59a

Means followed by the same letter are not significantly different at P≤ 0.01

Table 3: The influence rate of chemicals (%)

Characters (Application Mode)		Average rate of chemical influence (%)
Copper oxychloride	(to the infectious area on branch and trunk	37.70b
Benomyl	(to the leaves) (to leaves)	39.13b
Carbendazim	(to leaves)	38.72b
Copper oxychloride+Benomyl	(to branch and trunk +the leaves)	45.52a
Copper oxychloride+Carbendazim	(to branch and trunk +the leaves)	48.47a

Means followed by the same letter are not significantly different at P≤ 0.05

Results show considerable differences in average rate of influence depending on the application of chemicals. The most effective combination was found as Copper oxychloride+Carbendazim and Copper oxychloride+Benomyl combinations. The difference of influence between Copper oxychloride, Benomyl and Carbendazim was not (Table 3).

DISCUSSION

The development of disease in control mode is greater than the chemical applied modes by the level of 0.05 and 0.01 in the average values. The combinations of Copper oxychloride+Carbendazim and Copper oxychloride+Benomyl provide best results considering both the disease development rate and chemical influence rate criteria. These decisions approve the results of a research done to determine the effects of various carbendazim concentrations on *C. parasitica* infections for various grafting methods.

In the research, 0.5, 1 and 2% carbendazim concentrations were applied to the grafting locations for mechanical cleft, whipand bark grafting and T and ring budding methods, carbendazim was effective against canker disease, but at the highest concentrations reduced the percentage of successful grafts primarily on bark and T-budding grafts[17].

In another research in which some fungusits were added to the chemicals, it was found out that the effect of carbendazim was enhanced if mineral oil or Siapton L10 was added[12]. This is also in parallel with our research. Present Study proves that the simultaneous application of chemicals on both green parts and branches-trunk is more effective however, since the green part application is not possible for high trees, the simultaneous application is limited for the bushes only and this is a restriction. The post-application infections are not controlled by the method described in research and this is another disadvantage. Nevertheless, the method described in the research slows down the development of the disease in trees and the bushes and could be regarded as a success.

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