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A Study and Comparison of Control Methods of Anthracnose Disease in Walnut Trees of Roodbar Region

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Abstract: Walnut Anthracnose is among the major diseases of walnut trees in Qazvin Province which is scattered as an epidemic disease in the recent years. This research is designed to study and comparison of control methods of Anthracnose disease in walnut trees of Roodbar region. After selecting the infected garden and implementing winter and spring spraying treatments, winter spraying treatment and control treatment (which was only gathering of infected leaves and fruits), we counted the infected leaves and fruits in four geographical directions and calculated the percentage of infection; and finally the results were attained after statistical analysis. Winter spraying treatment with Bordeaux solution and spring spraying treatment with copper-containing compounds showed the maximum effects and minimum infection of leaves and fruits. Meanwhile, northward branches showed the maximum infection among all geographical directions.

Keywords: *Gnomonia leptostyla;* Walnut; Pathogenicity; Spraying treatments

INTRODUCTION

Walnut tree is among important multi-purpose trees, its fruit has high nutritional value and it is an exportable agricultural products. Walnut wood and even its leaves are usable in wood and veneer industry, dying, pharmaceutical and food industries. Walnut is among important agricultural products in Qazvin province which is found either in natural or cultivated forms in traditional or agro-industrial gardens. Therefore, development of walnut gardens and qualitative and quantitative production of walnut fruits shall have special importance [14, 13].

Walnut anthracnose is the most common leaf disease of walnut [3, 5]. When climatic conditions are favorable, the disease rapidly becomes epidemic and walnut trees may become prematurely defoliated. Premature loss of leaves results in poorly-filled, low-quality, darkened kernels [1, 6, 8 ,12]. The fungus attacks the leaves, nuts, and shoots of the current season's growth. The dark brown, more or less circular leaf spots vary from 1/16 to 5/16 inch in diameter. When individual spots merge, larger dead areas form. Most leaf spots are bordered by a yellow ring. Defoliation usually follows leaf infection but sometimes the infected leaflets remain attached to the tree for much of the growing season. There is no correlation between the number of spots on the leaflet and whether or not it drops [2, 4, 8, 12 and 16]. This fungus appears on thinner branches in the forms of oval lesions or irregular circles with brown color tending to grey and with reddish brown peripherals. At the time of outbreak of disease, the fungi may appear on green outer layer of fruits in the form of circular black or brown stains causing the fruit to be small and flesh part of fruit to be unripened. At the middle of season,

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black points will appear on the upper part of the infected leaves bearing reproductive organ of fungi. These organs produce bicellular spindle-shaped conidia somewhat tending to limber (embowed) shape. Reproductive organs in fungi will appear in late winter on leaves and fruits of the infected trees [1, 2, and 8].

The amount of rain and the duration of wet periods from the time of pollination up to harvest hold the key as to the seriousness of anthracnose on walnut trees of Roodbar region [4].

Black [12] studied the methods for diagnosis and control of Anthracnose disease in walnut tree .Disease Control may not be required where trees are being grown exclusively for timber and where disease does not appear each year. But control measures may be needed where trees are being grown for a nut crop or where the site has a history of annual anthracnose epidemics [2, 16].

It was reported that Cultural.-Interplant walnut with autumn-olive (Russian olive) or nitrogen fertilization of young plantations suppresses anthracnose infestations [16]. Also Chemical.-Apply the fungicide benomyl as a foliar spray, for control has been affected [7, 12, and 16]. Objectives of Research were Indicating the most proper method for control of Anthracnose in Walnut tree; selecting the most proper time for campaign against anthracnose in walnut tree and controling of outbreak of disease in epidemic form and decreasing damages of such disease to walnut gardens of the region.

MATERIALS AND METHODS

This research was conducted in 2009 at village of O'lia city of Roodbar region .Three treatments as follows were made after selection of targeted gardens for study and after gathering the infected leaves and fruits in autumn and dividing the garden into three sections:

Treatment 1 – Winter-time spraying with 2% Bordeaux solution (the first midmonth of March); and spring-time spraying with 0.3 percent Copper Oxychloride (the first midmonth of April)

Treatment 2 - Winter-time spraying with 2% Bordeaux solution (the first midmonth of March)

Treatment 3 – Control treatment- only picking up the infected leaves and fruits

For analyzing effects of treatments on walnut trees, in each treatment we selected four trees (four repetitions) and 4 branches in all four geographical directions and counted the total number of branches as well as the infected branches in the second midmonth of May. Such treatment was carried out again for infected fruits in the second midmonth of June. Analyzing the data was carried out using the factorial plan on the basis of complete-random blocks. The statistical analysis was performed using Microsoft Excel (2007) and SAS software (SAS Institute Inc, 1996) and means were compared using Duncan's multiple range test (DMRT).

RESULTS AND DISCUSSIONS

Results from effects of after implementing experimental treatments and sampling trial plots envisioned for sampling infected leaves in the second midmonth of May and for infected fruits in the second midmonth of June revealed that there is significant difference between treatments on 1% level regarding percentage of the infected leaves (Table 1).

Table 1 – Average of squares of the effects of treatments on characteristics of Percentage of infected leaves and fruits

Sources of changes	DF	Percentage of infected leaves	Percentage of infected fruits
Repetition	3	19.299NS	14.07ns
Spraying treatment	2	2502.726**	2599.665**
Geographical direction of branch	3	46.014*	361.891**
Spraying treatment * Geographical direction of branch	6	9.541NS	32.01*
Error	33	14.437	28.129
Change coefficient (%)	-	8.37	14.56

ns, *, and **, respectively, represents lacking of significant difference, and significant differences on %5 and %1 levels.

Table 2- Comparison of average of levels of chemical treatments, geographical direction and correlative effects.

Spraying of infected trees	Direction	Percentage of infected leaves	Percentage of infected fruits
Winter + spring		9.208 c	15.51 c
Winter		13.03 b	25..70 b
Control treatment		32.53 a	40.48 a
Winter + spring	West	9.335 a	12.95 d
	East	9.375 a	13.78 d
	South	7.305 a	14.74 d
	North	10.82 a	20.56 cd
Winter	West	11.62 a	22.99 c
	East	14.06 a	23.79 c
	South	12.05 a	23.47 c
	North	14.42 a	32.64 b
Control treatment	West	30.18 a	37.98 b
	East	31.74 a	34.69 b
	South	30.52 a	37.20 b
	North	37.67 a	53.50 a

Treatment levels with at least one common letter have no statistical significant difference on 5% level.

All treatments were varied base on the effects of treatments on Percentage of infected leaves and fruits.

As in Table 2 is showed that treatment 1 (winter and spring sprayings) having 9.21% of infected leaves was at the marginal rank (minimum) and control treatment (without spraying) with 32.53% of infected leaves was at the top rank (maximum) (Table 2 and Fig. 1). As indicated in Table 2, treatment 1 (winter and spring sprayings) has significant preference against treatment 2 (winter spraying) in regard to infected leaves. In recent years, the studies on control methods of anthracnose disease in walnut trees support our findings [16].

In regard to geographical directions of branches we saw significant difference on 5% level for the infected leaves. The result of comparison of averages showed that north direction with an average of 20.97 had the most infections; and it was put on a separate statistical group (Table 2 and Fig. 2). The correlation between "spraying" and "direction" had no significant meaning in regard to percentage of the infected leaves. Analysis of the results of treatments on percentage of the infected fruits showed a significant difference in spraying treatments and geographical treatment on 1% level as well as a significant correlative difference on 5% level (Table 1).

The result of comparison of averages (Table 2) showed that treatment 1 (winter and spring sprayings) had the minimum infected fruits with 15.51% and control treatment (only collection of leaves) had the maximum one with the percentage of 40.84%. The results indicate a significant difference between two treatments of chemical campaign against this disease and proved that twice spraying, one in the spring and another in the winter will decrease infection up to 10% in comparison to once spraying in the winter (Fig. 3). These results are very similar to those reported by [1, 2, and 7].

Among geographical directions, north direction had the maximum infected fruits (35.56%) in

comparison to other directions; therefore, it was categorized in a separated group (Table 2 and Fig. 4). The correlative effects of spraying treatments and geographical direction of branches on infection of fruits was significant; and analysis of averages showed that control treatment (without spraying) and northward direction had the maximum infection of fruits with the quantity of 53.5%. In treatment of averages, winter and spring spraying and in correlative effects of geographical directions, western, eastern, and southern directions had had minimum infection of fruits respectively, with the percentage of 12.95%, 13.78%, and 14.74%.

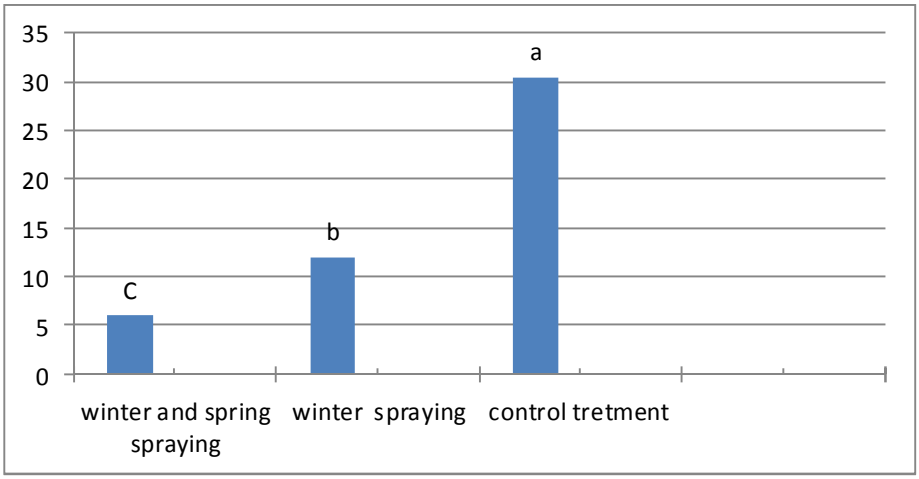

Fig. 1. Effect of spraying treatments on leaf infection percentage

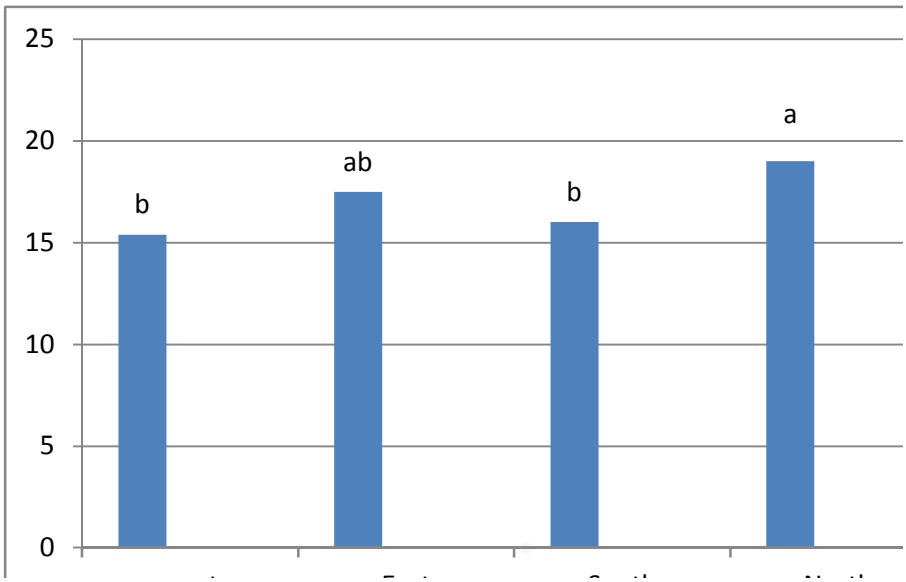

Fig. 2. Effect of geographical directions treatments on leaf infection percentage

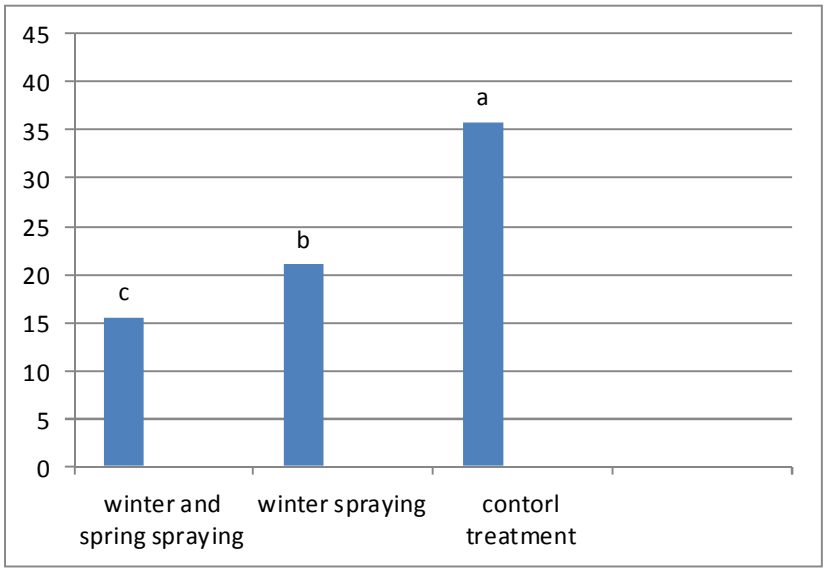

Fig. 3. Effect of spraying treatments on fruit infection percentage

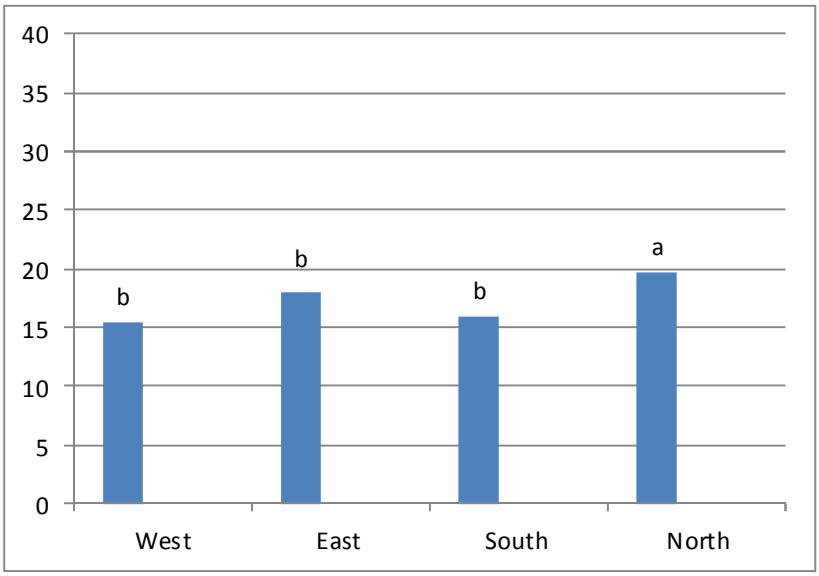

Fig. 4. Effect of geographical directions treatments on fruit infection percentage

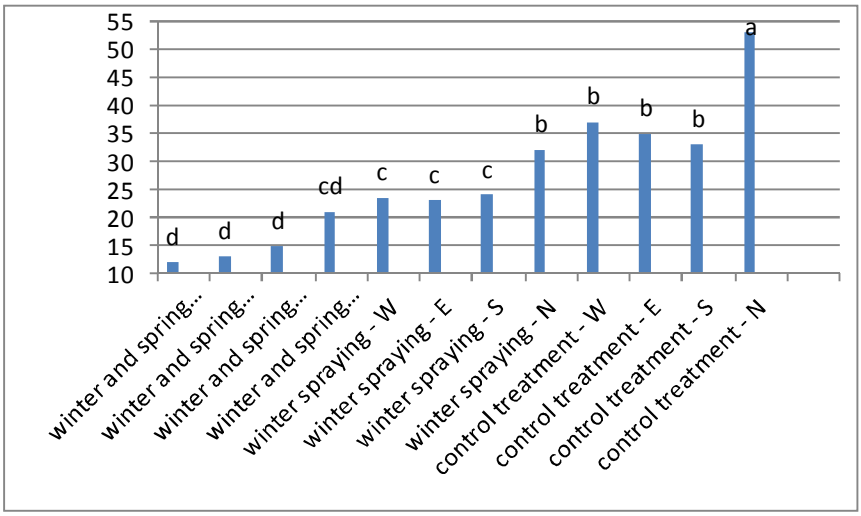

Fig. 5. Correlative Effects of spraying treatments and geographical directions treatments on fruit infection percentage

According to the results of this research it was understood that the best way for campaign against Anthracnose disease, further to gathering and picking the infected leaves and fruits at the end of each season for banning sporogenesis stage of fungus and initial inoculums, spraying at the beginning of each season twice a year (in winter with Bordeaux solution and at the beginning of spring with copper compounds), shall have the maximum effect on control of disease. Spraying at the end of winter collapses spores of fungi and complementary spraying in spring will collapse and control the remaining spores which may grow out at the beginning of spring after absorption of humidity concurrently with increase of raining. In the light of the fact that walnut tree is among economic trees in the Province and in Alamout region, having an average production of 1.50 tons per hectare, and considering the net value of dried foods which it produces, it is the income source of many rural families. According to the result of this research and application of mechanical and chemical treatment, we may decrease damages up to 15%.

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