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THE EFFICACY OF SOME ORGANIC PRODUCTS IN THE CONTROL OF BROWN ROT (*MONILINIA* SPP.) IN EUROPEAN PLUM (*PRUNUS DOMESTICA* L.)

Claudiu MOLDOVAN[1], Ioan ZAGRAI[1], Luminița ZAGRAI[1], Georgeta GUZU[1] Smaranda ROȘU-MAREȘ[1], Aurel MAXIM[2]

[1]Fruit Research & Development Station Bistrița, 3 Drumul Dumitrei Nou, 420127, Bistrița, Romania
[2]University of Agricultural Sciences and Veterinary Medicine of Cluj-Napoca, 3-5 Calea Mănăştur, 400372, Cluj-Napoca, Romania

Corresponding author email: maxim0067@yahoo.com

Abstract

Organic crops in fruit growing are constantly increasing due to the market demand for residue-free products. In this context, successful organic crops require an effective control of major diseases and pests. Brown rot caused by Monilinia spp. is one of the most important and common diseases with great economic impact in plum crop. The objective of this study was to evaluate the efficacy of some organic products in brown rot control into a plum orchard by assessing disease incidence when compared with treatments with conventional fungicides. An experimental scheme of phytosanitary treatments (organic and conventional) was carried out on two plum cultivars ('Stanley' and 'Reine Claude d'Althan'), throughout two consecutive vegetative periods (2020-2021), comprising a total of six treatments with fungicidal effect. The experience was divided in three blocks: organic, conventional and untreated control. According to the results obtained along the two years of study, the average frequency of brown rot damage for both plum cultivars was 9.5% in the conventional variant, 14.3% in organic variant, while untreated variant recorded 23.1%. The results revealed a agood potential for brown rot control by usingthe organic scheme treatments proposed but it's need to be confirmed in a long term study so that to become a suitable and reliable candidate to replace the conventional one.

Key words: *brown rot, control, disease, organic crop, plum.*

INTRODUCTION

Organic cultivation of fruit trees has started to expand due to the increasing consumer demand for organic fruit with no chemical residues (Neelesh & Attika, 2015; Maxim, 2008; Hamm et al., 2002). This cropping system has also been promoted in Romania through the European non-reimbursable funds granted under Measure 4.1.a of the National Rural Development Program 2014-2020. In this context, where fruit tree acreage is constantly expanding in the organic system, some shortcomings are also reported (Sisquella et al., 2014; Lopez-Reyes et al., 2013). The most important issues are related to effective crop protection, since the number and actual effectiveness of new products accepted in organic farming is low (Lacey et al., 2015; Manoj, 2017). Therefore, farmers who practice this type of system are exposed to significant economic losses due to disease and pest infestation.

Plum is one of the most important and widespread fruit crops in Romania, with an annual production of over 750,000 tons, ranking the second in the world after China, according to the latest technical data (FAO, 2020). The plum crop is affected by various harmful organisms that can endanger the fruit production if an efficient protection against diseases and pests is not carried out. Among the most common diseases of plum that causes significant losses is brown rot (Byrde & Willetts, 1977; Van Leeuwen, 2000; Hrusti'c et al., 2012). In Europe, the most encountered species from the genus *Monilinia* are: *Monilinia fructigena*, *Monilinia laxa* and *Monilinia fructicola,* the last one being a quarantine pathogen in Europe (EPPO, 2007; Usall et al., 2015). This disease affects flowers, leaves, shoots, and fruits and has a negative

impact on the quality and quantity of production (De Cal et al., 2009; Byrde & Willetts, 1977). Without an adequate phytosanitary protection, this mycosis can lead to complete yield loss in years with extremely favorable climatic conditions for the fungus. Local microclimate is an element that plays a crucial role in the initiation and maintenance of the disease (Miessner & Stammler, 2010; Hong et al., 2000; Hong & Michailides, 1999).
The aim of this study was to verify the efficiency of some organic products in the control of brown rot in European plum.

MATERIALS AND METHODS

During vegetative periods of 2020-2021, at Fruit Research & Development Station Bistrita was tested an experimental model in order to evaluate the impact of an ecological treatment scheme to control brown rot. The experimental plot was established into a plum orchard eight years old with two cultivars: ‘Stanley’ and ‘Reine-Claude d'Althan’. The design of experiment consisted in three blocks: organic, conventional and untreated variant, each block included a number of nine trees of each cultivar: ‘Stanley’and ‘Reine-Claude d'Althan’, divided into three repetitions. The treatment scheme included six sprays with fungicides, in both organic and conventional variants. The products were applied by spraying with an atomizer. The organic products with fungicide effect tested were the following: 20% copper sulfate, 60% *Mimosa tenuifolia* and 20% citrus extract, 20% citrus seed extract and mimosa tree bark extract 80%. The chemicals products with fungicid effects tested in this study were: Copper hydroxide + 50% Cu metallic copper, 26.7% boscalid + 6.7% pyraclostrobin, tebuconazole 250 g/L, mancozeb 80%, diphenoconazole 250 g/liter , chlorothalonil 500 g/l. The concentrations used for all products applied in the experiment were in accordance with the manufacturer's recommendations.
To determine the damage degree of brown rot symptoms on fruits, the methodology used in plant protection was applied. The frequency (F%) was noted for each repetition of each variant on 300 fruits, than the average for each variant was calculated. The statistical differences between cultivars and treatment variants were checked using One-way Anova test (Microsoft excel).

RESULTS AND DISCUSSIONS

The results obtained along the vegetative periods 2020-2021 depend on treatment variants in terms of frequency of brown rot infection, being influenced by climatic conditions. Abundant rainfall correlated with humidity and positive temperatures created a favorable environment for mycosis development. Thus, according to the climatic conditions registered in FRDS Bistrita, 2021 proved to be a more favorable year for the occurrence and development of brown rot than 2020.
The dynamics of climatic factors in the two years of study did not affect the way in which the plant protection treatments were carried out, since they were adapted to the weather conditions in order to achieve the maximum effectiveness. The results of this study regarding the efficacy of tested products on the occurrence of brown rot in plum orchards are shown in figure 1.

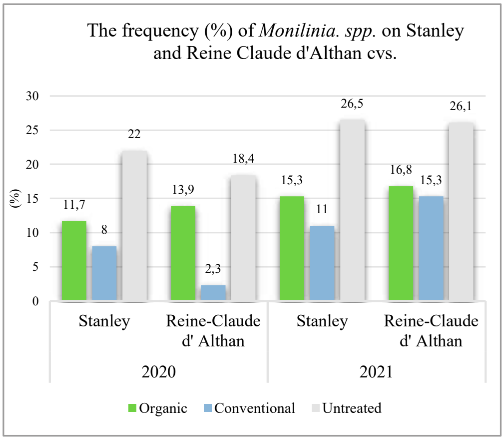

Figure 1. Incidence of brown rotin plum cultivars (2020-2021)

The incidence of *Monilinia.* spp. in the organic variant of 'Stanley' in 2020 was 11.7%, close to the conventional variant, while the untreated control variant had an incidence twice as high. Regarding 'Reine-Claude d'Althan', the difference between the organic and conventional variants was higher.

According to the 2020 results, which were quite similar to those of 2021, the incidence of brown rot in the organic variant was close to that in the conventional, whereas in the untreated control was almost twice as high.
The average frequency over the two years of the study once again highlighted differences depending on the treatment variant and cultivar (Figure 2).

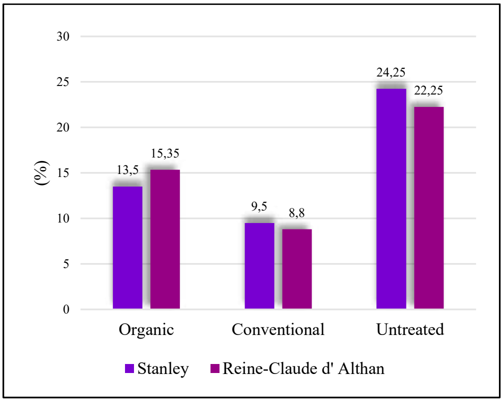

Figura 2. The average frequency of *M. spp.* along two consecutive vegetative periods (2020-2021).

The One-way Anova test performed on the average values of the frequency of brown rot revealed the existence of significant differences between both treated variants (organic and conventional) and the untreated control in the year 2021 (F value is bigger than critical F value or 2 df and α=0,05 in both cases). Regarding the year 2020, only treated trees by applying conventional scheme displayed significantly less damage than the untreated control. In this case calculated F value (19.93) is bigger than critical F value (18.51) for 2 df and α = 0.05 while for the organic variant the calculated value is smaller and therefore the differences are not significant. For both years there were no significant differences between the two treated variants for 2 degrees of freedom and α = 0.05.
Our data show increased damage in 2021 in all three variants and both cultivars and this could be due to the bigger number of rainy days in August 2021 (14 days) than in August 2020 (6 days) and a total of 35 rainy days in the second part of the summer 2021 compared to 28 rainy days in the same period of 2020 (July-September). Rainy days and a warm weather in preharvest period are providing optimal conditions for the fungus to spread and develop (EPPO, 2020). As Figure 3 shows, the year of 2021 offered better conditions for the fungus.

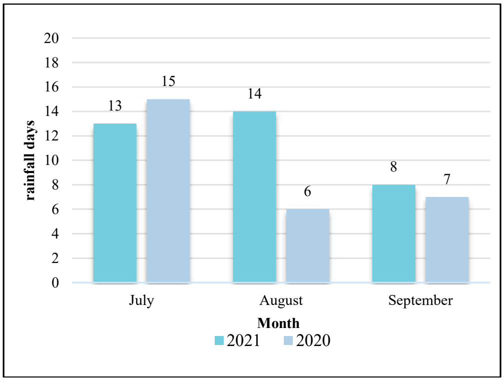

Figure 3. Distribution of the number of days with precipitations in the second part of the summer, in the two years 2020-2021

CONLUSIONS

The organic scheme treatments applied in our experimental plot against *Monilinia* spp. revealed its potential for disease control, encouraging the ecological way of brown rot control. However, this kind of scheme treatments need to be confirmed in a long term study so that to become a suitable and reliable candidate to replace the conventional one.

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