

Original Article

The Study of the Incidence of Powdery Mildew (*Microsphaera abbreviata* L.) attack in an Oak Nursery in Climatic Conditions of Pădurea Mare, Satu Mare County

COVRIG Ilie¹, Ioan OROIAN^{2*}, Dacian POP², Mădălina COVRIG¹, Petru BURDUHOS¹,
Ovidiu ȘTEFAN¹

¹Faculty of Horticulture, University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca, 3-5, Calea Mănăştur, 400372 Cluj-Napoca, Romania

²Faculty of Agriculture, University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca, 3-5, Calea Mănăştur, 400372 Cluj-Napoca, Romania

Received 17 October 2017; received and revised form 9 November 2017; accepted 28 November 2017
Available online 30 December 2017

Abstract

The forest health and vitality is threatened by lots of biotic and abiotic aggressors, and thus results that global forest ecosystems are affected by a range of diverse factors. The research is aimed at the study of the incidence of powdery mildew in an oak nursery from Pădurea Mare, Satu Mare County, and the effectiveness of measures taken in order to fight against the above mentioned disease. Ternary mineral fertilizer NPK, 15:15:15 was used at a dose of 200 kg/ha. Phytosanitary treatments were performed with 5 products of synthesis. Data were processed with program STATISTICA v 8.0. The most effective management solutions for *Microsphaera abbreviata* L. fungus to produce oysters in oak trees in the Pădurea Mare Nursery consist in administering treatments with Nativo 300 and Allegro products. The strongest correlations are reported between attack degrees of *Microsphaera abbreviata* L. and the precipitation regime, ranging from $R = 0.328$, in the case of the Spheres 535 SC and $R = 0.242$ phytosanitary products, in the absence of phytosanitary treatments.

Keywords: Attack degree, cluster analysis, correlation, statistics.

1. Introduction

The health and vitality of global forest ecosystems is affected by a range of factors, from phytopathogenic agents (pests, viruses, fungi, bacteria, etc.) to environmental factors, disrupters (droughts, floods, fires, etc.), and air pollutants [2].

These disruptive, biotic and abiotic factors, naturally encountered in forest ecosystems, are a real challenge for establishing forest management objectives and their implementation [1]. Worthwhile mentioning in this context is that a wide range of pests can have a negative impact on the forestry sector. In support of the above, we highlight the situation in 2010, where, according to FAO reports, forest insects destroyed more than 35 million hectares of forests annually, especially in temperate and boreal areas [1, 3, 4, 5].

Domestic pests and pathogens can become a significant problem, especially when they proliferate intensely and become the focus of attack for tree species specific to the forest habitat in which they occur. Also, many damage is caused by pests and

* Corresponding author.
Tel: +40-262-59638
Fax: +40-264-593792
e-mail: ioan.oroian@usamvcluj.ro

non-specific pathogens for a particular area that have been accidentally introduced into the ecosystem through trade in forest products, live plants and other commodities. Because non-specific pests and pathogens for a particular forest area have not evolved alongside forests, they have great potential for damage, and their impact may sometimes be devastating. In such situations, pests and pathogens artificially introduced into a forest area do not benefit from natural enemies that normally keep the population balanced [5].

New host trees may have insufficient or no resistance to the action of new pathogens and pests. Climate change also appears to influence the establishment of pests in new locations, as well as increasing the severity of the impact of both indigenous pests and pathogens and newly introduced population populations [1].

The research is aimed at the study of the incidence of powdery mildew in an oak nursery from Pădurea Mare, Satu Mare County, and the effectiveness of measures taken in order to fight against the above mentioned disease.

2. Material and Method

The biological material used in the researches consisted of oak saplings. Oak (*Quercus robur*, Fabaceae) is a forest species that is frequently found alongside other deciduous species, forming the so-called woods.

It populates the temperate climate forests in Europe, North Africa and some Asian areas. Ternary mineral fertilizer NPK, 15:15:15 (S.C. Azomureș S.A.) was used at a dose of 200 kg/ha.

Phytosanitary products with which the treatments were made contain active substances that are part of different chemical classes. These are: Kumulus DF (BASF) with the active substance sulfur 80%, applied at a dose of 0.3%; Allegro (BASF) with the active substances kresoxim-methyl 125 g/L and epoxiconazole 125 g/L, applied at a dose of 0.9 L/ha; Nativo 300 SC (Bayer Crop Science) with the active substances tebuconazole 200 g/L and trifloxistrobin

100 g/L, applied at a dose of 0.8 L/ha; Sphere 535 SC (Bayer Crop Science) with the active substances trifloxistrobin 375 g/L and ciproconazole 160 g/L applied at a dose of 0.4 L/ha; Tilt 250 EC (Syngenta Crop Protection) with the active substance propiconazole 250 g/L, applied at a dose of 0.3 L/ha.

The implementation of the working methodology corresponds to a monofactorial experimental scheme with six graduations, in three rehearsals, related to the vegetation period April - Septembrie 2016. Data were processed with program STATISTICA v 8.0.

3. Results and Discussions

The research carried out in this study at the level of the Large Forest in the experimental field belonging to the Pădurea Mare Forestry, Satu Mare County, highlights simple correlations of different intensities between the climatic factors analyzed in the present study and the degrees of attack related to the experimental variants and witness, as well as between reported degrees of attack in the experimental period April - September 2015 (Table 1).

Between the average temperature of the experimental period April - September 2015 and the average values of humidity, wind speed and precipitation regime recorded during the same experimental period, negative correlations are recorded.

These are very weak for interaction with relative humidity and precipitation, but between the average temperature of the experimental interval of 2015 and the average wind speed expressed over the same time interval, the correlation is average ($R = -0.346$).

Relative humidity is negatively and very poorly correlated with wind speed, but a positive environment with precipitation ($R = 0.323$). The wind speed is correlated positively and very poorly with the precipitation regime in the experimental field (Table 1).

Table 1. The matrix of correlations between environmental factors (temperature, relative humidity, wind velocity, precipitation regimen), and powdery mildew (*Microsphaera abbreviata* L.) attack degrees (AD, %) recorded function of administered phytosanitary treatment, in Pădurea Mare nursery, Satu Mare Forestry District, 2016

Issue	h	v	pp	M	V1	V2	V3	V4	V5
t	-0.039	-0.346	-0.028	0.182	0.144	0.111	0.149	0.102	0.173
h		-0.075	0.323	0.242	0.231	0.204	0.202	0.269	0.237
v			0.048	0.086	0.032	0.036	0.041	0.033	0.052
pp				0.399	0.271	0.270	0.262	0.234	0.306

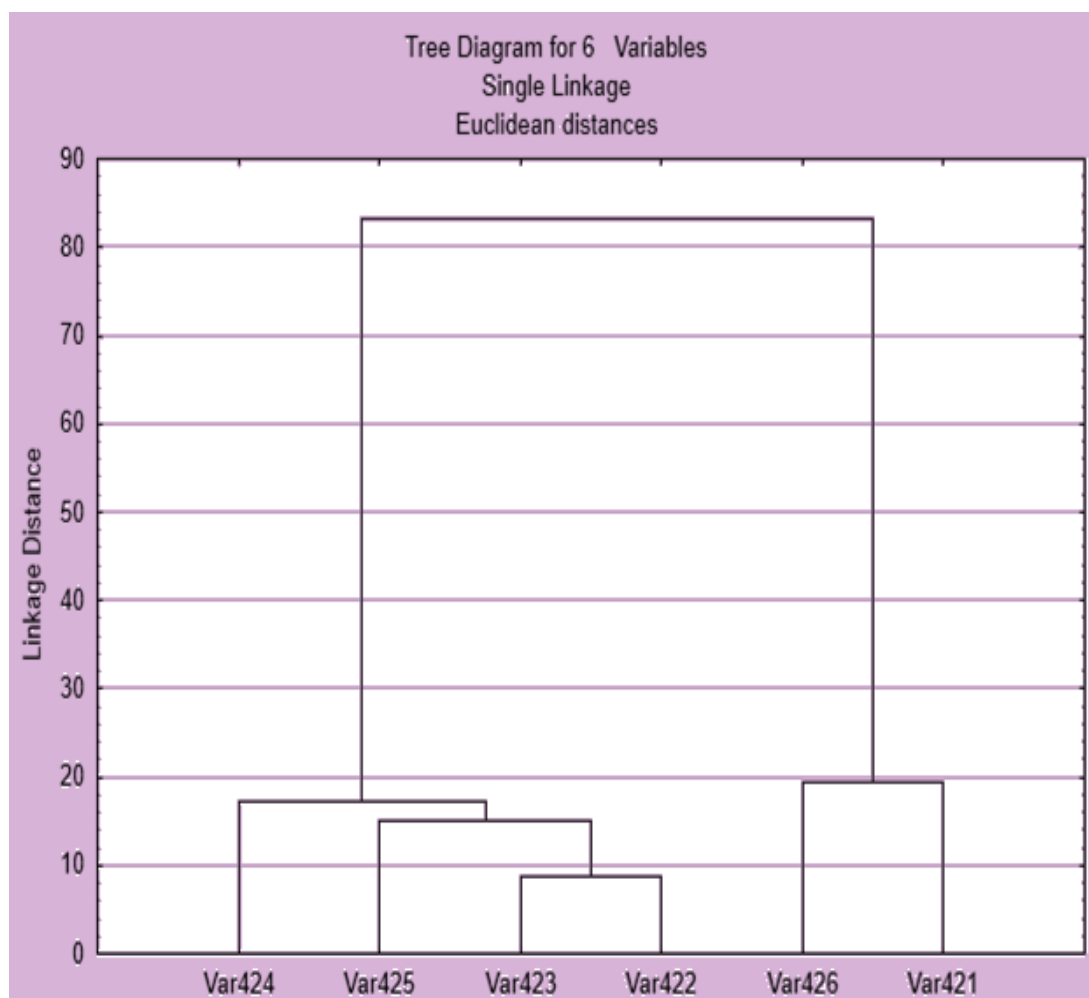
The study of the correlations between the analyzed climatic factors and the *Microsphaera abbreviata* L. attack on the oak seedlings in the Pădurea Mare nursery during the experimental period April - September 2015 shows that only the temperature, the relative humidity and the precipitation regime are the climatic factors correlated in a manner that imposes the study of their influence on the degree of attack of the pathogen analyzed, in the coding of the experimental variants in which different products for the control of mildew are used, as well as in the case of the control variant, in which no phytosanitary treatment is performed (Table 1).

Regarding the incidence of mildew, quantified by the calculation of attack degrees of *Microsphaera abbreviata* L. on oak saplings, recorded during the whole experimental period April - September 2015, according to the experimental variant studied, the cluster analysis reveals the existence of two main

clusters, corresponding to the degree of attack, recorded according to the phytosanitary solution tested to manage the pathogen attack.

The first cluster corresponds to the strongest attack rates, respectively, for the control variant (GA = 40.50%) and the experimental variant in which Tilt 250 EC-V5 was administered (GA = 38.50%). The other cluster includes the degrees of attack recorded in the other experimental variants and corresponds to a lower attack (Fig. 1).

It is noteworthy that this cluster is divided into three sub-sites, two of which correspond to each one of the experimental variants, namely those in which the phytosanitary management of the flour was done by administering Nativo 300 products (GA = 21.57%) and Sphere 535 GA = 24.61%), and the third is the phytosanitary treatments with Kumulus DF - V1 (GA = 24.85%) and Allegro - V2, respectively GA = 23.49% (Fig. 1).



Var 421 –AD recorded in control; Var 422 - AD for V1; Var 423 - AD for V2; Var 424 - AD for V3; Var 425 - AD for V4; Var 426 - AD for V5.

Figure 1. The cluster analysis applied to powdery mildew (*Microsphaera abbreviata* L.) attack degrees (AD, %) function of administered phytosanitary treatment, in Pădurea Mare nursery, Forestry District Satu Mare, by entire experimental period, 2016

The linkage distances highlighted for pathogen attack rates reported by each experimental variant suggest the superiority of the phytosanitary management solution to oak saplings in the Pădurea Mare under the experimental conditions of 2015, which consists in administering the Nativo 300 (Figure 1).

4. Conclusions

The most effective management solutions for *Microsphaera abbreviata* L. fungus to produce oysters in oak trees in the Pădurea Mare Nursery consist in administering treatments with Nativo 300 and Allegro products between May and September 2016 and in April 2016 with Allegro and Sfera 535 SC products. The worst results are obtained in the absence of any phytosanitary treatment as well as in the case of Tilt 250 EC. In all experimental variants, the incidence of mildew in Great Lakes nursery is superior to that recorded in the previous experimental year, but the differences between the degrees of attack of the fungal pathogen corresponding to the two experimental years are not statistically assured at the significance threshold of 5%. The lowest average pathogen attack rates are reported for phytosanitary treatments with Nativo 300, GA = 23.24% and Allegro and GA = 24.78%, respectively. The most extensive attack of mildew is recorded in the experimental variant in which no phytosanitary treatments were carried out, i.e. a tactile degree of the pathogen equal to GA = 42.61%, as well as the conditions of the phytosanitary treatments with the product Tilt 250 EC, respectively a degree of

pathogen attack equal to GA = 41.41%. Also in this experimental year, between the degrees of attack recorded between the control variant and those corresponding to the experimental variants in which phytosanitary treatments were administered, except those in which the treatment was performed with the product Tilt 250 EC, are statistically ensured at the materiality threshold 0.1%.

The strongest correlations are reported between attack degrees of *Microsphaera abbreviata* L. and the precipitation regime, ranging from R = 0.328, in the case of the Spheres 535 SC and R = 0.242 phytosanitary products, in the absence of phytosanitary treatments.

References

- [1] Agrios G.N., 2001, Plant Pathology. Fourth Edition. Academic Press. San Diego, Ca. USA, p: 635; Anonimo. 1951. Notas Fitopatologicas-I. Agricultura tehnica, 10(2), 86.
- [2] Covrig I., I. Oroian, A. Odagiu, L. Holonec, E. Oroian, 2016, *A. hippocastanum* L. and *T. cordata* Mill. as Biomonitoring Plants for Air Pollution in Urban Areas. A Case Study: City of Cluj-Napoca, Environmental Engineering and Management Journal, 15 (5), 995-1002
- [3] Oroian L., V. Florian, L. Holonec, 2006, Atlas de fitopatologie, Ed. Academiei Române, București.
- [4] Popescu G., 2005, Tratat de patologia plantelor, Vol.II, Ed.Eurobit, Timișoara.
- [5] ***, 2004. Codexul produselor de uz fitosanitar omologate pentru a fi utilizate în România.

"This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution and reproduction in any medium, provided the original author and source are credited."