

Original Article

Identifying the Intensity of the Interrelationship between Climatic Factors Temperature and Humidity on *Microsphaera abbreviata* L. Attack in *Quercus robur*

OROIAN Ioan¹, Constantin ȘULEA¹, Ilie COVRIG^{2*}, Dacian POP, Petru BURDUHOS¹

¹ University of Agricultural Sciences and Veterinary Medicine, Faculty of Agriculture,
3-5 Calea Mănăștur Street, 400372, Cluj-Napoca, Romania

² University of Agricultural Sciences and Veterinary Medicine, Faculty of Horticulture,
3-5 Calea Mănăștur Street, 400372, Cluj-Napoca, Romania

Received 2 October 2016; received and revised form 25 October 2016; accepted 1 November 2016
Available online 30 December 2016

Abstract

The trial was carried out in an oak forest located in the Forestry Direction Reghin, County of Hunedoara. The trial was conducted for a three years period, 2012 – 2014. Quantification of the interrelationship between climatic factors temperature and atmospheric and powdery mildew attack degree on oak trees located within experimental area, using multiple regression analyze, was the aim of our study. This relationship was identified as strong in 2012 ($R = 0.828$), moderate in 2013 ($R = 0.535$), and moderate to strong ($R = 0.637$), in the last experimental year, 2014, respectively. We also noticed that within climatic conditions of the first experimental year 2012, temperature have a positive contribution, while atmospheric humidity have a negative contribution to the increase of the powdery mildew attack degree, in last experimental years, 2012, and 2014, respectively,, both, temperature, and humidity positively contribute to the increase of the powdery mildew attack degree.

Keywords: correlation, parameter, regression line, statistics.

1. Introduction

The tree growth is a quantitative trait of stands. It is irreversible increase in the size of their parts and the basis of phytomass production and productivity of forests. So growth occurs as a bio accumulative process while development refers to qualitative changes, marked by moments through which stands along their existence. This complex is going under the action of specific laws and conducted by its own dynamics based on inverse connection [1, 3, 5].

The structure of a tree stand as result of its growth and development is a dynamic process. The dynamic nature of biometric features of the stands is found in the tables of production [4, 5].

Tables' production aspect biometric is a dynamic stochastic model development stands that, within a certain probability, can be used to estimate the likely value of production stands. Probabilistic nature of production data in tables in the fact that between height and volume of trees or stands there is a perfect correlation; on the one hand, due to differences in shape that exists between trees grown under very different conditions, and on the other because of the structure of the stand, in other words, the differences regarding distribution of trees in diameter classes, which should depend to some extent cultural nature of the transactions.

* Corresponding author.
Tel: +40-264-596384
Fax: ++40-264-593792
e-mail: ilie.covrig@usamvcluj.ro

Hence a table production stands only gives good results which have been practiced in the same way as in the cultural operations that led to the drafting table [2, 3]. The concept of production stands can provide two-way, meaning that the strictly technical production process means that a timber harvest and wider which means the biological process of growth forest.

The aim of our trial was to quantify the influence of the interrelationship between temperature and atmospheric humidity upon the manifestation of the harmful effects of the powdery mildew (*Microsphaera abbreviata* L.) attack degree within experimental conditions, using statistical methodology of multiple regression analyze.

2. Material and Method

Our trial was installed within an oak (*Quercus robur*) forest belonging to the Forestry Direction Reghin, County of Hunedoara (45°51'0" N and 23°0'36" E), during a three years period, from 2012 to 2014, taking into account a five months interval April - August, respectively, for each year [6, 7].

The attack degree of powdery mildew (*Microsphaera abbreviata* L.), was estimated in connection to the evolutions of the temperature and atmospheric humidity recorded within the same experimental areal with an mobile climatic station, and according to methodology described by Oroian, 2012 [5]. The statistical programme STATISTICA v.8.0 for windows was used for processing data in

order to perform the multiple correlation analysis, meaning the calculation of the coefficient of multiple correlation between powdery mildew attack degrees (%), temperature (°C), and atmospheric humidity (%); the coefficient of determination, and regression line.

We also took into account the graphic representation, using the response areas, of the complex interaction between the above mentioned parameters.

3. Results and Discussions

Thus, as specified, the identification of the role played by temperature (°C), and atmospheric humidity (%) in as climatic factors of first range in manifesting the harmful effects of the intensity and frequency of the powdery mildew, produced by the mushroom *Microsphaera abbreviata* L. represented the premise of performing the multiple analysis and applying in order to quantify tis interrelationship. Regarding the *Microsphaera abbreviata* L. pathogen attack and influence during the experimental temperature and humidity in the area studied in Hunedoara, multiple regression analysis yielded some positive correlations environments and powerful, the whole experimental period (Figs. 1-3).

The climatic conditions of experimental 2012 (Fig. 1), the highest degrees of attack can be achieved at temperatures between 4 - 20°C and humidity 50 - 70% (AD = 16-35%) and the same temperature range from humidity 40 - 65% (AD > 36%).

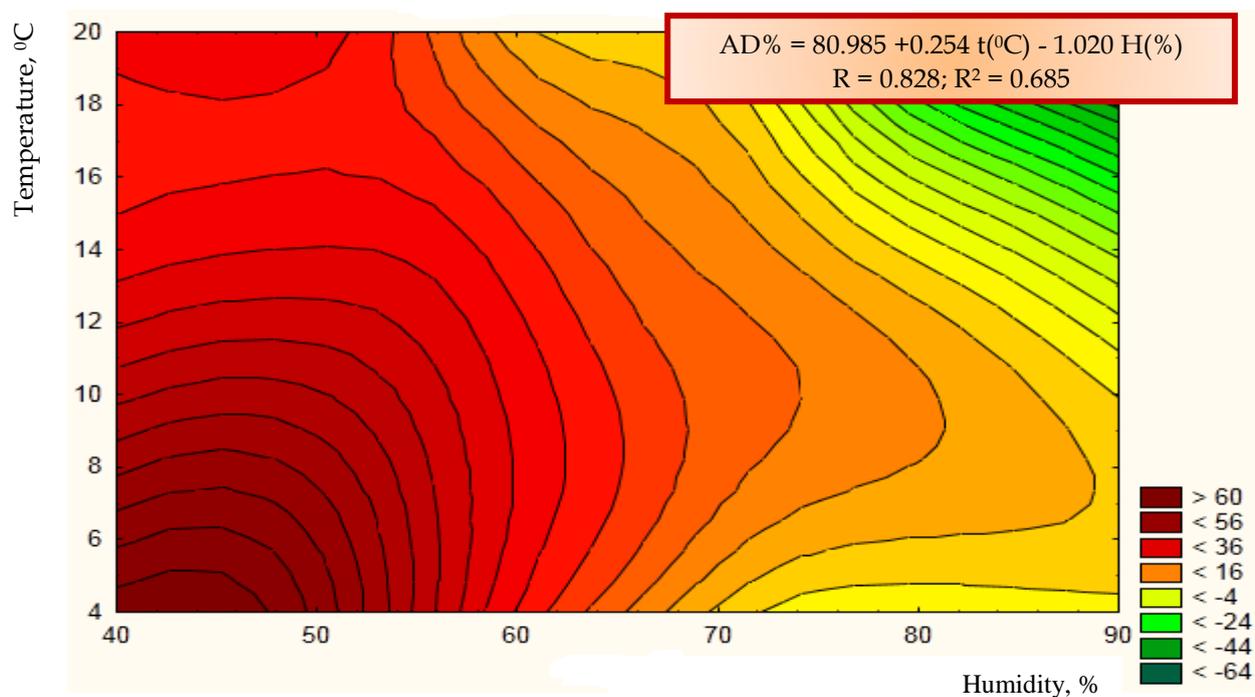


Figure 1. The evolution of the *Microsphaera abbreviata* L. attack degree function of temperature and humidity, during experimental year 2012, Hunedoara

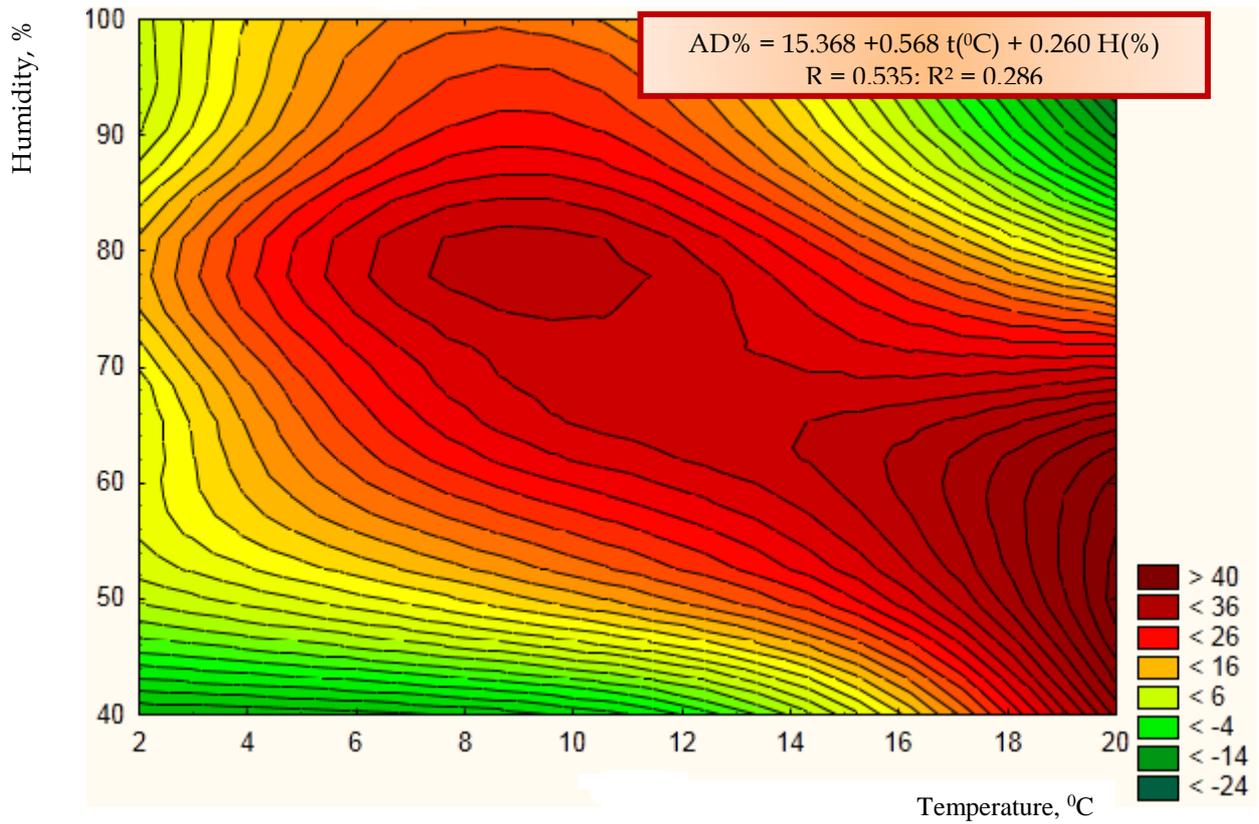


Figure 2. The evolution of the *Microsphaera abbreviata* L. attack degree function of temperature and humidity, during experimental year 2013, Hunedoara

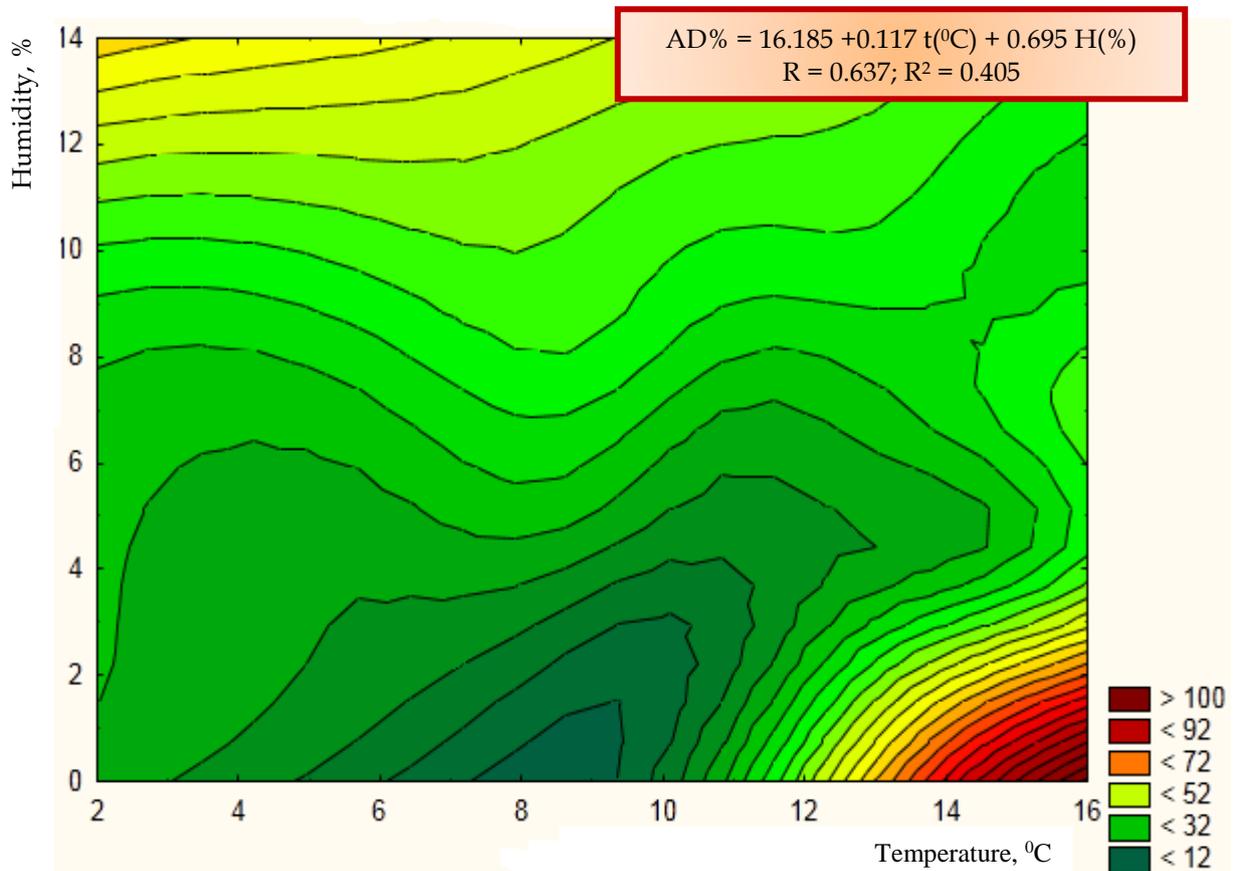


Figure 3. The evolution of the powdery *Microsphaera abbreviata* L. degree function of temperature and humidity, during experimental year 2014, Hunedoara

In the second experimental year, namely 2013 (Fig. 2), the highest degrees of attacks may be obtained at temperatures between 3 - 18°C and humidity 40 - 100% (AD = 16 - 35%), 8 - 18°C, humidity 40 - 90% (AD = 36 - 40%) in the ranges of 8 - 12°C and 16 - 20°C humidity of 70-80% and 16 - 60% (AD > 40%).

The climatic conditions of this year experimental characterized both average temperature and average humidity higher than the previous year, resulted in a positive multiple correlation $R = 0.535$ equal to the average, 28.60% of the representative sample (Fig. 2).

The year 2014 was characterized by multiple positive correlation between the degree of medium to strong attack *Microsphaera abbreviata* L., temperature and humidity equal to $R = 0.637$, representative of 40.50% of the sample (Fig. 3).

A value of the attack degree between 13 - 51% can be achieved in the temperature range 2 - 16°C and humidity 8 - 14%. The highest levels of attack can be recorded at temperatures between 13 - 16°C and humidity 2 - 20% (AD > 40%).

The climate of the last experimental year was characterized by the lowest average temperature of the experimental period, respectively 16.59°C, but the highest humidity - 70.52%, it is characterized by multiple positive correlation medium to large, intermediate value other experimental years (Fig. 3).

4. Conclusion

The climatic conditions of each experimental year influence in a specific manner interrelationship between powdery mildew attack degree, temperature and atmospheric humidity. Thus in 2012, this relationship was of strong intensity ($R = 0.828$, which makes available the results of the statistical analysis for 68.50% of studied cases), while in 2013 and 2014, it was of moderate, ($R = 0.535$, which makes available the results of the statistical analysis for 28.60% of studied cases) and moderate to strong ($R = 0.637$, which makes available the results of the

statistical analysis for 40.50% of studied cases) intensity, respectively.

While within the climatic conditions of the first experimental year, 2012, the temperature contributes to the increase of the intensity of correlation between powdery mildew attack degree and climatic factors, and humidity to the decrease of the above mentioned correlation, in the last two experimental years, 2013, and 2012, respectively, both climatic factors contribute to the increase of the powdery mildew attack degree upon the oak trees from the experimental areal.

References

- [1] Abrudan I.V., 2006, Împăduriri, Editura Universității Transilvania Brașov.
- [2] Florescu I., 1999, Împăduriri. Pepiniere forestiere, Reprografia Universității Transilvania Brașov.
- [3] Florescu G., I.V. Abrudan, 2002, Împăduriri. Lucrări practice. Semințe Pepiniere, Reprografia Universității Transilvania Brașov.
- [4] Holonec L., 2004, Tehnologii moderne in protectia integrata a padurilor clujene, Editura AcademicPres, Cluj - Napoca.
- [5] Oroian I., 2012, Protecția plantelor - principii și tendințe, Editura Bioflux Cluj - Napoca, Romania.
- [6] Șulea P., 2015, Efectul factorilor biotici dăunători asupra arboretelor de cvercinee și măsuri de gestionare a fenomenelor de uscure a acestora în Transilvania, Teză de doctorat, Universitatea de Științe Agricole și Medicină Veterinară Cluj - Napoca
- [7] ***, 2002, Ordonanță de urgență nr. 38 din 21 martie 2002, privind întocmirea și finanțarea studiilor pedologice și agrochimice și finanțarea Sistemului național de monitorizare sol-teren pentru agricultură, precum și solvegetație forestieră pentru silvicultură, Monitorul Oficial nr. 223/3.04.2004.

"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."