THE DYNAMICS OF FOLIAR DISEASES OF WHEAT IN THE CLIMATE OF TRANSYLVANIA PLAIN

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INTRODUCTION

Wheat, a staple food crop, is susceptible to various foliar diseases that can significantly impact yield and grain quality. Among the most prevalent and economically significant wheat foliar diseases are powdery mildew, septoria leaf blotch, and wheat rust. The impact of these diseases can vary from year to year, but they are always present and can pose a significant challenge, even if they only affect certain plant parts. These diseases can occur individually or in combination, presenting a complex challenge for wheat growers and researchers. Knowing how diseases develop and spread helps in implementing effective control strategies. This includes timing fungicide applications, choosing resistant cultivars, and adjusting cultural practices. Understanding disease dynamics helps develop strategies to decrease economic losses. Knowledge of disease dynamics informs breeding programs aiming to develop wheat varieties with improved resistance to foliar diseases. The dynamics of these foliar diseases are influenced by environmental factors such as temperature, humidity, rainfall, and wind patterns. Pathogen virulence and the genetic susceptibility of the wheat cultivar are also crucial factors that determine disease severity and impact.


Blumeria graminis


Zymoseptoria tritici


Pucinia striiformis


Pucinia recondita

MATERIAL AND METHODS

In order to better understand foliar diseases and their timing of appearance, which are critical factors in limiting wheat production losses, weekly monitoring of the autumn wheat crop was carried out at the Agricultural Research and Development Station (ARDS) Turda during the agricultural years 2022-2023 and 2023-2024. The goal was to document the progression of powdery mildew, septoria leaf blotch, and wheat rust throughout the growing season.

The study used six wheat cultivars - Apache, Taisa, Codru, Dumbrava, Arieşan, and Andrada - to monitoring the progression of foliar diseases. We adopted the subdivided parcels method, with three replications, to closely monitor the development and spread of these diseases across the different wheat varieties. The study used cultivation practices specific to wheat production, but did not utilize any fungicide application. Disease incidence and severity were assessed weekly according to standard protocols on each leaf, and the data collected was used to calculate the attack degree and to analyze the dynamics of disease development over the season.

Table 1

The thermal regime, ARDS Turda 2022-2024

Temperature (^{0}C) 2022-2023												
Month	September	October	November	December	January	February	March	April	May	June	July	August
Decade I	17	12.2	8.9	2.9	3.7	-3.5	5.7	4.9	13.3	19	21.3	20.5
Decade II	14.1	14.6	4.7	0.2	4.2	1.4	5.4	10.8	14.2	17.8	23.7	22.3
Decade III	11.9	10.6	2.7	1.7	0.8	4.4	7.8	10.7	18.3	20.2	20.5	23.3
Monthly average	14.3	12.4	5.4	1.6	2.8	0.5	6.3	8.8	15.4	19	21.8	22.1
65 years average	15.2	9.8	4	-1.2	-3.3	-0.6	4.4	10	15	18	19.8	19.5
Deviation	-0.9	2.6	1.4	2.8	6.1	1.1	1.9	-1.2	0.4	1	2	2.6
Characterization	normal	warm	warmly	warm	very warm	warmly	warmly	colder	normal	warmly	warm	warm
Temperature (^{0}C) 2023-2024												
Month	September	October	November	December	January	February	March	April	May	June	July	August
Decade I	18.6	13.2	9	2.2	2.8	6.5	8.1	14.8	15.5	20.2	22.7	21.3
Decade II	19.3	14.2	5.1	0.2	-1.2	6	7.1	13.2	14.6	20.8	27.3	25.5
Decade III	19	14.5	1.4	1.3	-0.8	8.6	10.9	12	17.1	24.2	22.2	23.6
Monthly average	19	14	5.2	1.2	0.2	7	8.8	13.3	15.8	21.7	24	23.4
65 years average	15.2	9.8	4	-1.2	-3.3	-0.6	4.4	10	15	18	19.8	19.5
Deviation	3.8	4.2	1.2	2.4	3.5	7.6	4.4	3.3	0.8	3.7	4.2	3.9
Characterization	warm	warm	warmly	warm	warm	very warm	warm	warm	normal	warm	warm	warm

Table 2

The pluviometric regime, ARDS Turda 2022-2024

Precipitations (mm) 2022-2023												
Month	September	October	November	December	January	February	March	April	May	June	July	August
Decade I	69.9	12.2	0.6	6	9.9	1.8	3.3	21.2	15	11.5	12.4	22
Decade II	32.3	3.9	25.5	17	24.2	3.8	2.3	7	17	72.9	9.6	17
Decade III	17.7	0.2	16.9	0.6	8.6	21.5	5.2	2.3	1.2	60.1	63.8	59.5
Monthly amount	119.9	16.3	43	23.6	42.7	27.1	10.8	30.5	33.2	144.5	85.8	98.5
65 years average	42.4	35.4	28.2	27.6	21.7	19.2	24.3	45.6	69.4	84.6	78	56.1
Deviation	77.5	-19.1	14.8	-4	21	7.9	-13.5	-15.1	-36.2	59.9	7.8	42.4
Characterization	excessively rainy	excessively dry	excessively rainy	a little dry	excessively rainy	very rainy	excessively dry	very dry	excessively dry	excessively rainy	normal	excessively rainy
Precipitations (mm) 2023-2024												
Month	September	October	November	December	January	February	March	April	May	June	July	August
Decade I	19.4	0	6	4.4	2.1	0.6	14.3	0.6	36.4	15.4	35	21
Decade II	34.2	10.3	35.7	4.4	1.5	8.6	22.1	14.8	5.5	9.9	1.9	0
Decade III	62.5	9.5	1.9	9	1.2	0	1.3	23.4	18.8	10.9	12	15
Monthly amount	116.1	19.8	43.6	17.8	4.8	9.2	37.7	38.8	60.7	36.2	49	37
65 years average	42.4	35.4	28.2	27.5	21.7	19.2	24.3	45.6	69.4	84.6	78	56.1
Deviation	73.7	-15.6	15.4	-9.7	-16.9	-10	13.4	-6.8	-8.7	-48.4	-29	-19.1
Characterization	excessively rainy	very dry	excessively rainy	very dry	excessively dry	excessively dry	excessively rainy	a little dry	a little dry	excessively dry	very dry	very dry

(Source of primary data: Turda meteorological station (longitude: 23 ° 4´; latitude: 46 ° 35´; altitude: 427m)

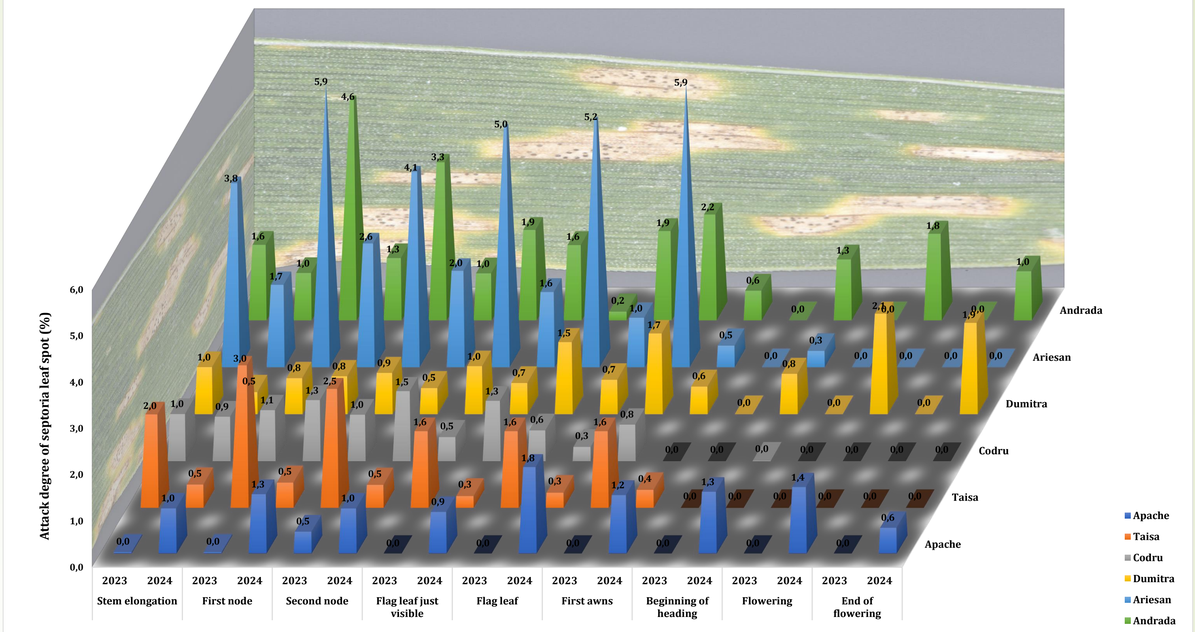

Figure 1. The evolution of the septoria leaf blotch (*Zymoseptoria tritici)* attack degree

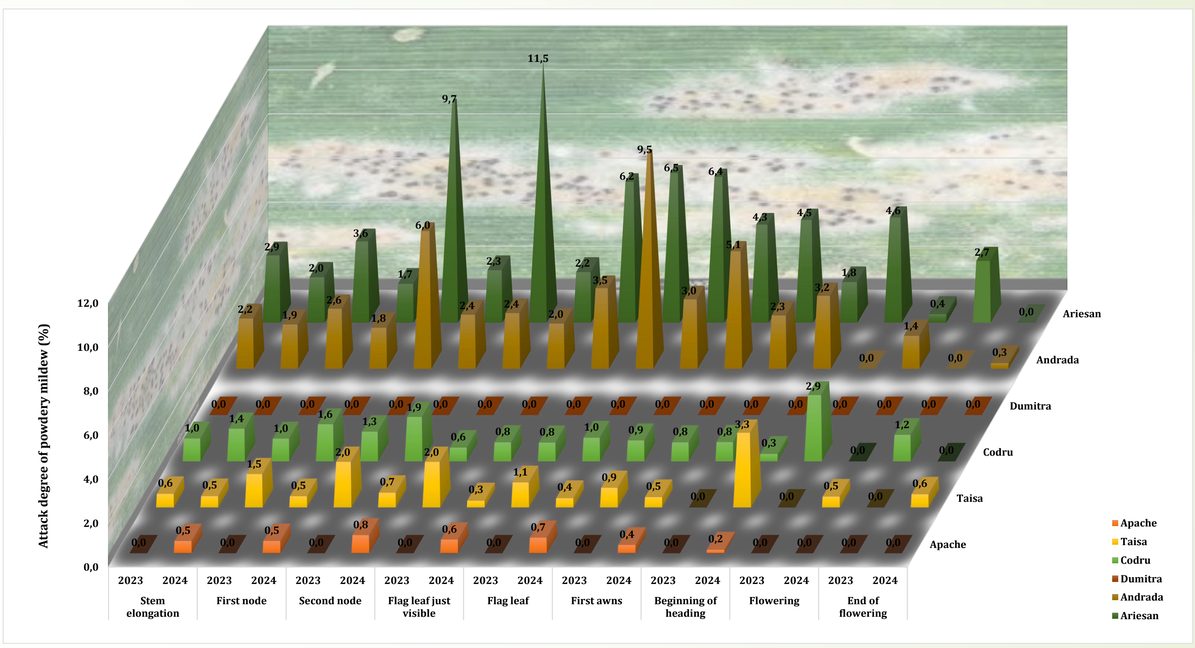

Figure 2. The evolution of the powdery mildew (*Blumeria gramini)* attack degree

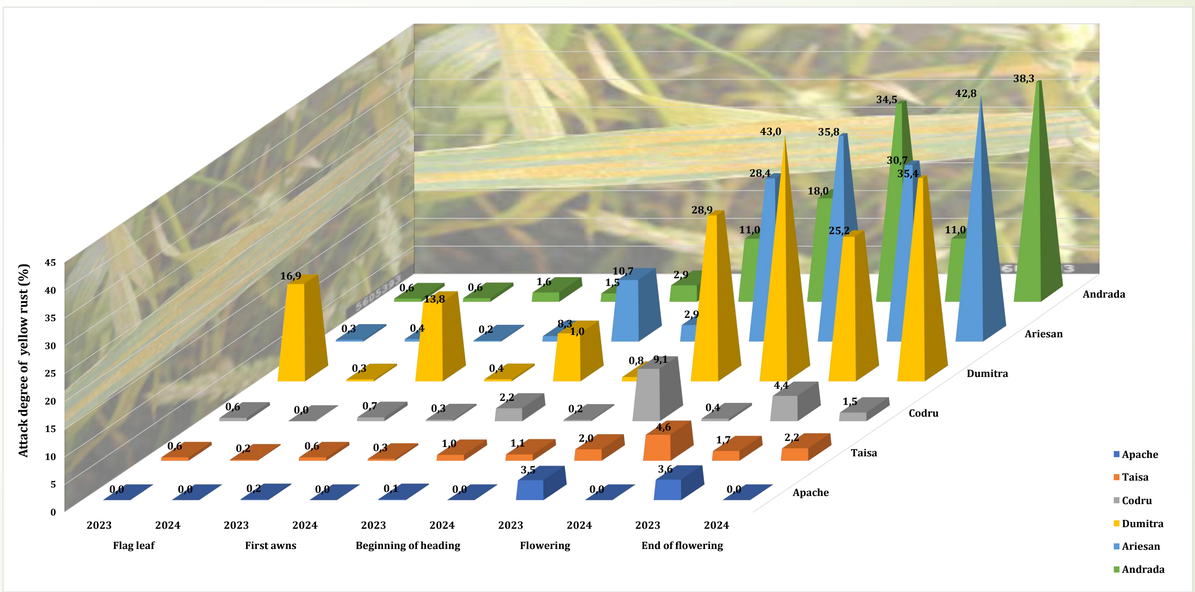

Figure 3. The evolution of the yellow rust (*Puccinia striiformis)* attack degree

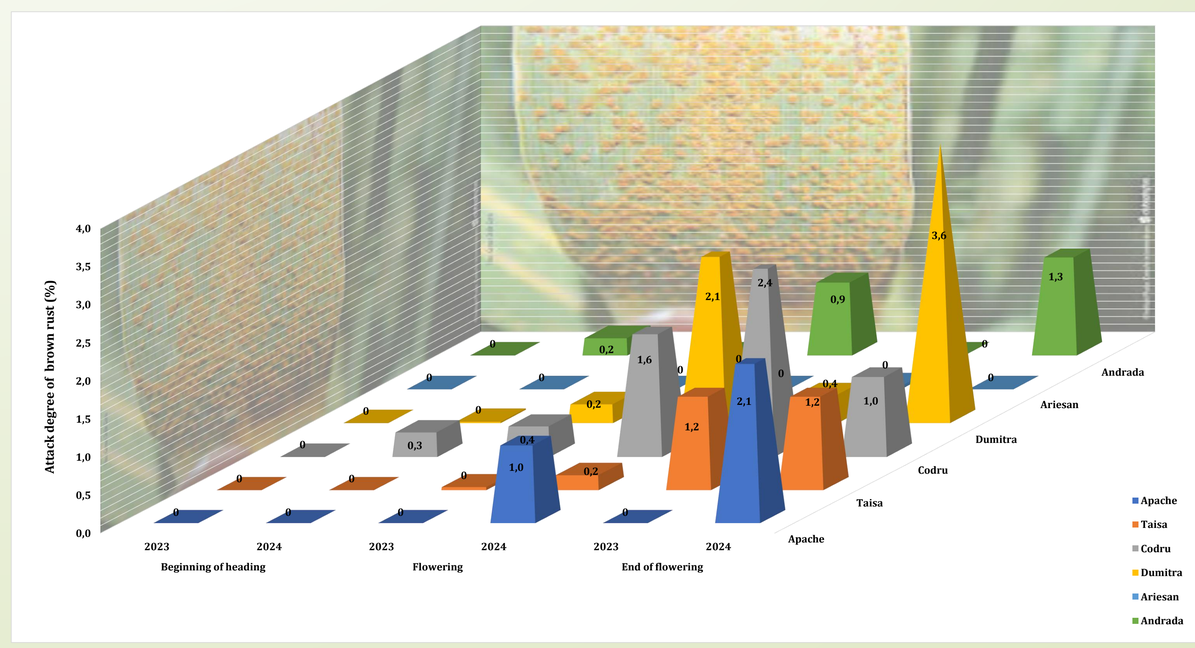

Figure 4. The evolution of the brown rust (*Puccinia recondita)* attack degree

CONCLUSIONS

Over the two experimental years, the pathogens that caused foliar diseases in the autumn wheat crop were *Zymoseptoria tritici*, *Blumeria graminis*, *Puccinia striiformis*, *Puccinia recondita*. No attack of *Blumeria graminis* has been reported for the Dumbrava variety. Regular monitoring provides essential data for disease forecasting, resistance management, and integrated diseases management (IPM), all of which are vital for enhancing food security, optimizing crop productivity, and promoting sustainable agricultural practices. By monitoring disease pressure and trends, researchers can contribute to the development of effective, timely, and economically viable solutions to control wheat diseases.

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